MECHANICAL HANDLING

INCORPORATING 'MATERIALS HANDLING'

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HIDDEN EXPORTS

THE state of the order book in the machine tool industry is now usually taken as a 'barometer' to forecast the prospects of industry in general. In view of the sharp increase in orders for machine tools which began last summer and has resulted in many firms being back to full production, it would seem that future prospects are very promising indeed.

There are, of course, other factors that can be taken as reasonably reliable indication, the production of steel, for example. Last year the British Steel industry produced 20 million tons, and the production of what is described as 'the critical field of cold reduced steel' was up by 13 per cent over 1958. This year it is likely to rise by as much as 20 per cent. The cement industry also gives news of a record year's production at 11·6 million tons.

Concurrently with announcements of record production in many industries, large-scale planning for even greater production in the future and exports at a record high level, comes news of new and valuable orders received from overseas. To quote just a few: there is a polyethylene plant to be built in Australia, to the value of £A4 million; a large rotary press order for Holland; a Swedish order for electric excavating shovels; a contract for the construction of a new Naval Headquarters at Apapa, Lagos, and a £100,000 order for materials handling plant in Spain.

Although, as the pages of this journal have shown, the mechanical handling industry is contributing in full measure towards the country's 'direct' exports of machinery and equipment, its achievements at times do not perhaps appear to be as spectacular as those of other industries and the full significance of its contribution towards those industries in the form of what may be termed as 'hidden exports' cannot be fully appreciated.

It would seem worth while, therefore, to suggest that more attention should be called to the vast quantity of mechanical handling equipment that is not classified as 'direct' export, but nevertheless leaves the country as an essential part of plant or equipment produced by other industries. The valuable contribution that our industry is making in the form of new techniques, equipment, research and 'know-how' to enable other industries to reach their record overseas sales figures should also be emphasized.

Seventh Mechanical Handling Exhibition - 1960

The Seventh Mechanical Handling Exhibition (organized by this journal) will be held at Earls Court, London, from Tuesday, May 3rd, until Friday, May 13th. Make a note.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

SUMMARY OF CONTENTS

For readers overseas

SOMMAIRE EN FRANÇAIS

INHALTSÜBERSICHT AUF DEUTSCH

SUMARIO EN ESPAÑOL

Ring Main Pneumatic Tube System

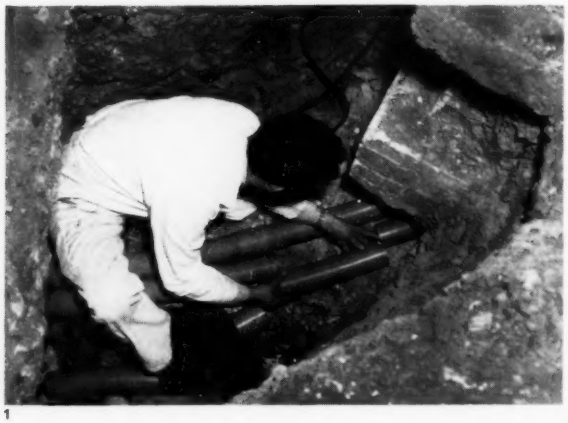

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Fig. 1. *An installation at the site of I.C.I. Plastics Division headquarters in which the piping is made from I.C.I. 'Corvic' by Chemidus Plastics, Ltd. This picture illustrates a typical method of running Dialled Despatches tubes in underground ducts or other enclosed cavities*

Fig. 2. *Another view of the installation at I.C.I.*

Fig. 3. *A typical receiving and sending station with electronic control unit top right*

Fig. 4. *This close-up view of a send/receiver station at I.C.I. shows a carrier and the method of inserting it into the tube*

THROUGH the application of electronics and acoustic principles a pneumatic tube transmission system has been introduced by Dialled Despatches, Ltd., which consists of a single unplasticized PVC tube ring main, and from which up to 45 separate stations can be operated with intercommunication between all the stations.

Letters, documents and papers or any articles small enough to fit into the 1·8-in dia cylindrical carrier are passed through the system at speeds of between 20 and 30 m.p.h.

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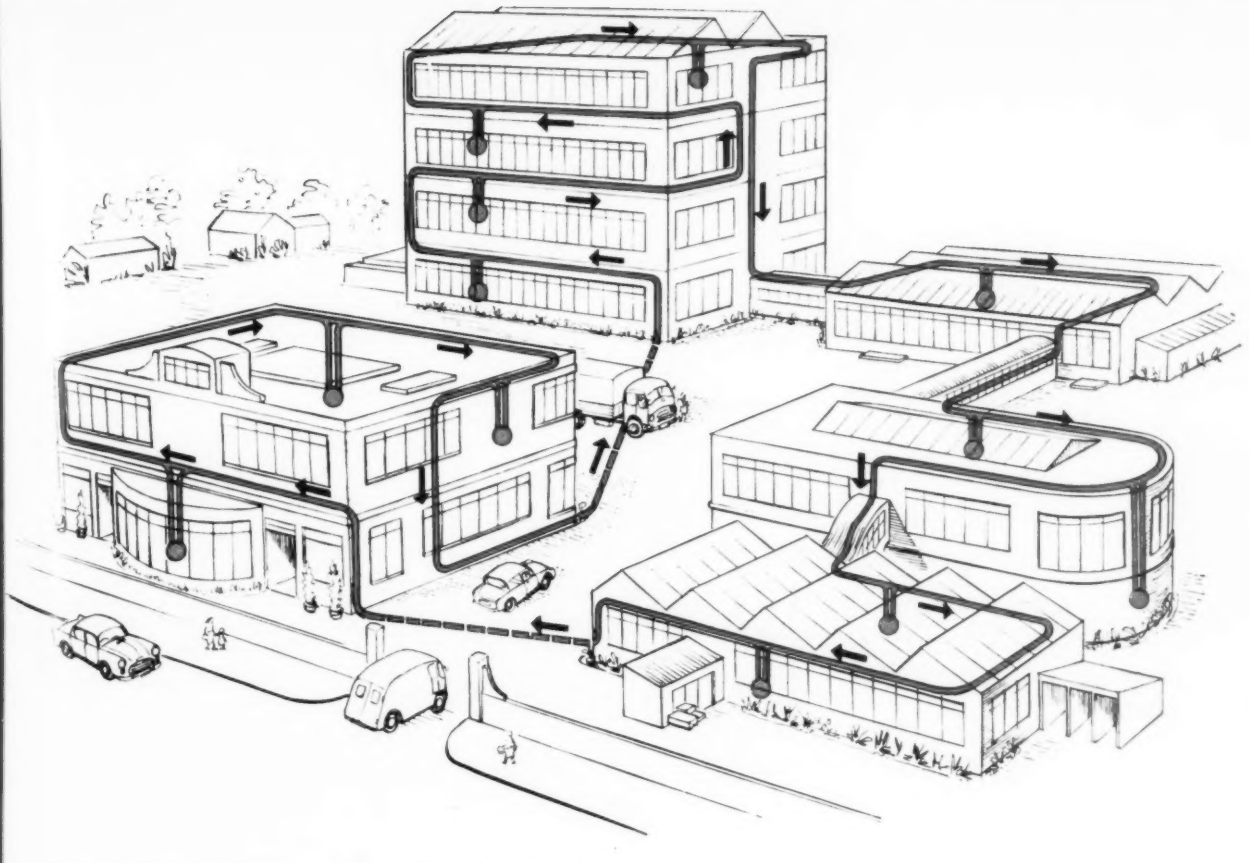

Fig. 5. Artists' impression of a typical factory installation which gives direct intercommunication between all stations in the circuit

An operator is not required because the carriers are 'homed' to their stations by an ingenious automatic device. This consists of a simple switching arrangement known as the dialling head, which is mounted in the rear of the carrier body. The act of dialling means that a tuned reed is set to vibrate at a particular sonic frequency as the carrier travels through the tube. The note emitted by the reed is generated by the passage of air over the reed and for each number indicated on the dial there is a distinctive note.

As the carrier travels through the tube it passes a microphone situated at the approach to each station, which is coupled to the tuned circuit and amplifying system corresponding to one of the reeds in the tone head. As soon as the microphone picks up a note emitted by an approaching carrier, and which is of the same sonic frequency, it operates an electronic relay which in turn operates a diverter so that the carrier is deflected into the receiving unit on the station.

As all the carriers must travel in one direction, clockwise or anti-clockwise, it means that one half of the communication between two adjacent stations involves the carrier in a journey through almost the complete tube circuit. Owing to the high average speed of the carrier the time lag is of no consequence, but in order to prevent collision between carriers a form of automatic traffic control is used, which consists of a traffic switch, microphone switch, receiving switch and junction switch, together forming a series of electrical interlocks. Should a carrier or carriers already be in transit through the main transmission tube, the injection of another carrier into the main tube is automatically delayed for a second or two, should an oncoming carrier have already passed the traffic switch at that station.

As there is normally no airflow in the station branch tubes foreign matter cannot be introduced into the system. It is only when a carrier is inserted into the ascending unit, and the flap is closed, that the diverters operate so as to give an airflow through the station branch tubes. As soon as the main transmission tube is free, the air diverted into the branch tube lifts the carrier swiftly into the main transmission tube. Directly the carrier reaches the main tube the diverters are reset, so sealing off the air in the branch tubes and allowing the air to flow in the main circuit. The airflow is continuous through the main tube but the exhauster shuts down automatically after about 15 minutes when carriers are not being sent. Immediately a carrier is inserted into the ascending tube at one of the stations the plant is automatically switched on by remote control. Should a carrier be wrongly dialled, or inserted incorrectly into the system, it will make two complete circuits of the ring and then be rejected automatically at a station in the system designated 'The Reject Station', in addition to its normal function.

Carriers are available in lengths of 8, 11 or 12 in. They have an open-ended unbreakable plastic cylinder within the metal carrier measuring 1·8 in dia by either $5\frac{1}{2}$, $8\frac{1}{2}$ or $9\frac{1}{2}$ in long, according to the size of the metal carrier. For routine sampling from industrial processes specially designed carriers can be supplied to handle most sampling problems.

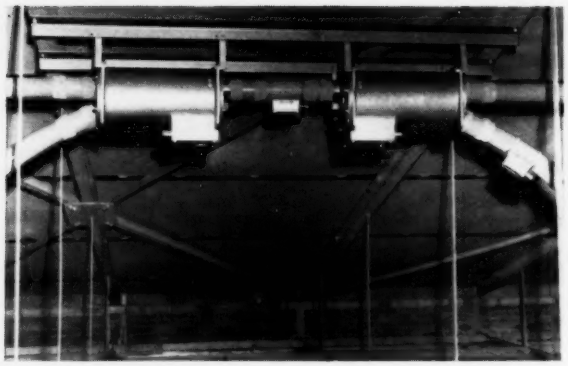

Fig. 6. Two diverters mounted between roof trusses

Fig. 7. Diverters mounted in a roof and showing the down tubes to send/receiver stations in offices below

Fig. 8. The tube with fittings takes up little room as shown by this overhead installation

If desired, carriers can be fitted with locks so that they can only be opened by the sender and recipient with special keys.

One of the most outstanding features of this system is the extremely small size of the air exhauster unit, which, therefore, can be housed in a very small space. The air exhauster unit is a BVC-type TO turbo-exhauster, designed on the high-speed turbine principle. It is a multi-stage composite unit, which can either be bolted to the floor or fitted to a base plate with felt underbed. It occupies only 5 sq. ft. and is completely smooth-running without pulsing.

The electronic control unit, of which one is located at each station, incorporates a 'band-pass' characteristic in the selecting circuit which ensures that any slight variation in the emitted signal of a carrier will have no effect on the correct functioning of the control unit. Should a fault occur, however, at any one station, the rest of the system is unaffected and will continue to function normally. The unit is fitted with a removable chassis on which are installed the plug-in numerals corresponding to the figures on the carrier tone-head. This feature has its advantages when offices are replanned. Each electronic control unit has its own power supply and requires only a local single-phase A.C. supply to operate it.

The PVC tubing used throughout the system is $2\frac{7}{8}$ in internal dia and extruded to fine tolerances. A number of advantages over metal tubing are claimed, one of the most important being that the weight factor is reduced by five and the installation cost becomes correspondingly cheaper. Supporting brackets and other fixtures can also be of much lighter construction. Other advantages are immunity from denting and corrosion, good appearance and lessening of noise caused by carriers. In order to eliminate the risk of jamming all bends are pre-formed under controlled conditions at the company's works.

The majority of joints between the separate lengths of tube are made with plastic sleeves held with cement and at diverters and certain selected stations by rubber sleeves, to enable the system to be opened if necessary. This arrangement makes any alteration to the system such as the transfer

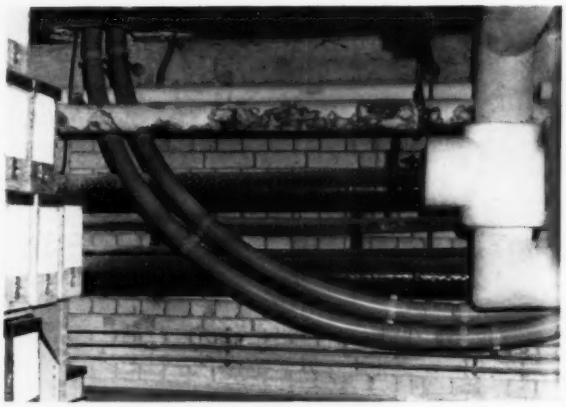

Fig. 9. (above). All bends are pre-formed before installation

Fig. 10. (below). Showing tubes accommodated in an existing pipe duct

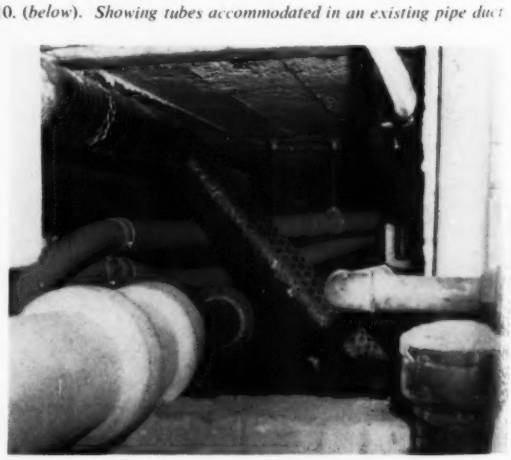

Fig. 11. The installation in the Post Room of I.C.I. Plastics Division

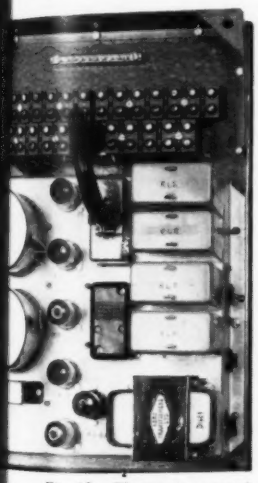

Fig. 12. Electronic control unit with cover removed

of a station from one department to another, a comparatively easy operation.

Dialled Despatches, Ltd., have already installed systems in a number of buildings and are in course of installing many more. At the Marchwood generating station of the Central Electricity Generating Board, Southern Division, which is one of the most modern conventional power stations in Great Britain, a ring main of some 2,400 ft long is used. Six receiving stations are provided and to cover the maximum distance between two stations a carrier takes approximately 50 seconds. A system has been provided for the new premises of Bradbury, Agnew & Co., Ltd., the printers of *Punch*. At the works of Kodak, Ltd., Telephone Rentals, Ltd., are installing a Dialled Despatches system which will have the specific function of conveying sensitized photographic emulsion and film samples from the production machines to the laboratory. This requires special light-proof containers which Kodak, Ltd., are supplying to fit the standard carrier unit.

At the Plastics Division of I.C.I., Welwyn Garden City, ring mains are being installed in two separate groups of buildings, the mains will be inter-connected so that it will be possible to send carriers direct between any station in one building to any station in the other. Some 6,000 ft of P.V.C. tubing made from I.C.I. 'corvic' polymer has been used for this installation, a good deal of which is situated underground. Where possible concrete-lined trenches, which already exist for other services to the various buildings on this extensive I.C.I. site, are being used to accommodate the pneumatic tubes. At the moment 13 stations are being provided in this system, but provision is being made for future extensions.

Another new installation is at United Africa House, London, which has been built for Unilever, Ltd. This new building has 11 floors plus basement and is covered by a single ring main installation, 3,000 ft in length, which serves 34 stations, the exhauster being located in a very small room in the basement.

The system described above, and the installations referred to, apply to Dialled Despatches' standard 3-in system, which uses a tube $2\frac{7}{8}$ in internal dia. A larger diameter version, which has a tube approximately 4·5 in dia and is known as the 'Four-point-five' system, is also now available. This is a straightforward 'scaled-up' version of the 3 in and has been designed to meet the requirements of hospitals and other organizations where the bulk of material to be carried is high. X-ray films, patients' records, drugs, syringes, pathological samples, drawings, magazines, files and folders of reasonable size can be accommodated.

A point of interest, in particular in connection with hospitals, is that the system does not aggravate cross-infection, because any slight air leakage at a station is discharged into the outer atmosphere and not conveyed into areas where other stations are installed.

Fig. 13. A carrier with its transport container removed and showing 10 and 45 station standard heads with the standard reed assembly in centre

By A. G. Douglas Clease, B.Sc., A.M.I. Mech.E.

A CONVEYOR FOR GLASS

A Teleflex installation for Triplex

OBVIOUSLY the safe transport of glass by overhead conveyor presents unusual problems. Glass is a fragile material which, if broken, becomes dangerous by reason of its sharp edges. It must therefore be handled gently on two counts, so that it shall not sustain damage and so that any fracture that may occur shall not cause injury to personnel. If it were suspended directly from any orthodox form of chain conveyor considerable screening for the total floor area beneath it would have to be provided in order to protect any personnel in the vicinity.

In the case of a conveyor at the Kings Norton, Birmingham, works of the Triplex Safety Glass Co., Ltd., there are other problems. The conveyor is required to transport curved glasses in pairs from the furnaces where they have assumed their curved shape to the assembly department where they receive the interlayer that eventually transforms them into a laminated safety-glass windscreen. The glasses are accordingly still hot when they leave the furnace, and it is necessary that they shall have cooled by the time they arrive at the assembly department.

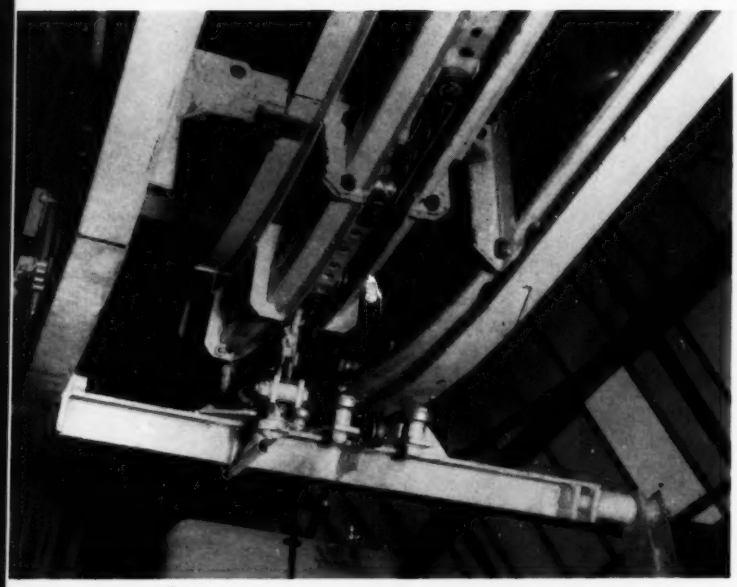

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Fig. 1. Showing the load-carrying members running on rollers in a track parallel to the Teleflex conveyor chain

Fig. 2. The carriage is connected by links to the conveyor chain and is propelled through coil springs when in the level portions of the system

Fig. 3. View showing the inverted T-section rail and how the glass carrier is suspended from the outrigger arm

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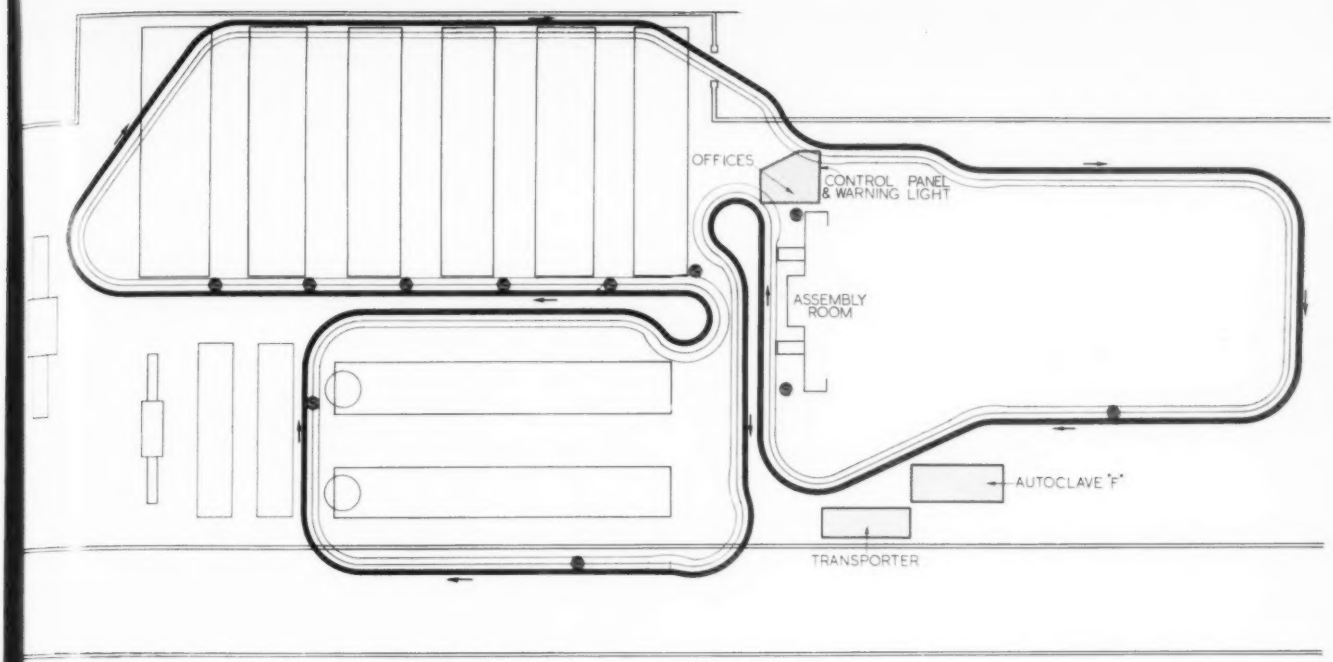


Fig. 4. Layout of the cooling conveyor system at No. 3 factory (S) *indicates safety switch*

The glasses may be of considerable size, owing to the pronounced wrap-round of the screen of the modern car. The conveyor must accordingly allow for easy loading at the furnaces and for easy unloading at the assembly department. It is also important that the glasses, which have been carefully selected for good optical quality, shall not be scratched or receive other damage that could impair that quality.

So difficult did the overall problem of designing and installing a suitable conveyor appear that by some it was considered insuperable. Teleflex Products, Ltd., and the Triplex company had other ideas, however, and by co-operation produced a solution which is highly original and, moreover, very successful.

In brief, the glasses are received in special containers or carriers suspended on outrigger arms from load-carrying members or carriages running on rollers on an overhead track parallel to the Teleflex conveyor chain. These carriages are linked to the conveyor chain and are propelled by it, but they are not supported by it. The weight of the glass in its carrier imposes a torque load on the carriage which is counterbalanced by a roller on the other end of the carriage beam running beneath another rail of inverted T section.

Details of this construction are shown in Fig. 1, a view taken from below at a point where the conveyor rises from loading level to normal running level. The links of the Teleflex conveyor chain with their rollers are seen within their track of double brim-to-brim top-hat section. To the right of this track is the load-carrying rail, on the top flange of which are seen the two load-carrying rollers of the carriage. In a plane at right angles to that of these rollers are four guide rollers, of which three only can be seen, running on the edges of the lower flange of the rail. Another guide roller is seen on a short arm projecting from the beam of the carriage; this runs on the bottom flange of the track and has a fellow roller hidden from view behind the carriage.

On the left is the inverted T-section rail below which runs the roller at the end of the carriage beam. Neither rail nor roller can be seen in Fig. 1 because at the lower or loading level of the conveyor a guard rail hides them from view. They are to be seen in Fig. 3, however, which also shows how the glass carrier is suspended from the outrigger arm, an oilite bush being used for the bearing on which the carrier frame is supported.

The construction of the carriage is shown in Fig. 6, in which are seen the links connecting the carriage to the Teleflex conveyor chain. The lower ends of these links are connected by coil springs to a projection from the carriage beam and are clearly seen in Fig. 2. The carriage is propelled through these springs therefore when it is on the level portions of the system, although on the inclines the angular movement of these links brings them towards the ends of the slots in the carriage through which they project towards the conveyor chain. The movement of the carriage is accordingly very smooth, and free from any jerkiness that could cause swaying of the glass carriers.

Normal operating height of the track is 14 ft 6 in to the top of the track, which gives a clear headroom of 6 ft below the glass carriers, but at the five loading positions at the furnaces the track curves down to an overall height of 7 ft 10½ in, bringing the bottom of the glass carriers to a height of 3 ft, which is the minimum possible because of the furnace unloading mechanism. At the unloading position at the assembly department the unloading height is reduced to 2 ft. 7½ in.

The boat-shaped carriers are 7 ft long by 2 ft 8 in wide, and they are spaced at 12-ft centres. The angle of the inclines between normal and loading levels is 60 deg. and it is to make this angle possible without the carriers fouling the track, and also without fouling each other at curves in the track, that recourse has been had to the outrigger design of the carriages. Without this cantilever construction the maximum permissible angle of the inclines would be only 11 deg.

Before installation of the conveyor the hot glasses from the furnaces were loaded on hand-propelled trollies, and as time had to be allowed for the glasses to cool before they were handled in the assembly department the result was

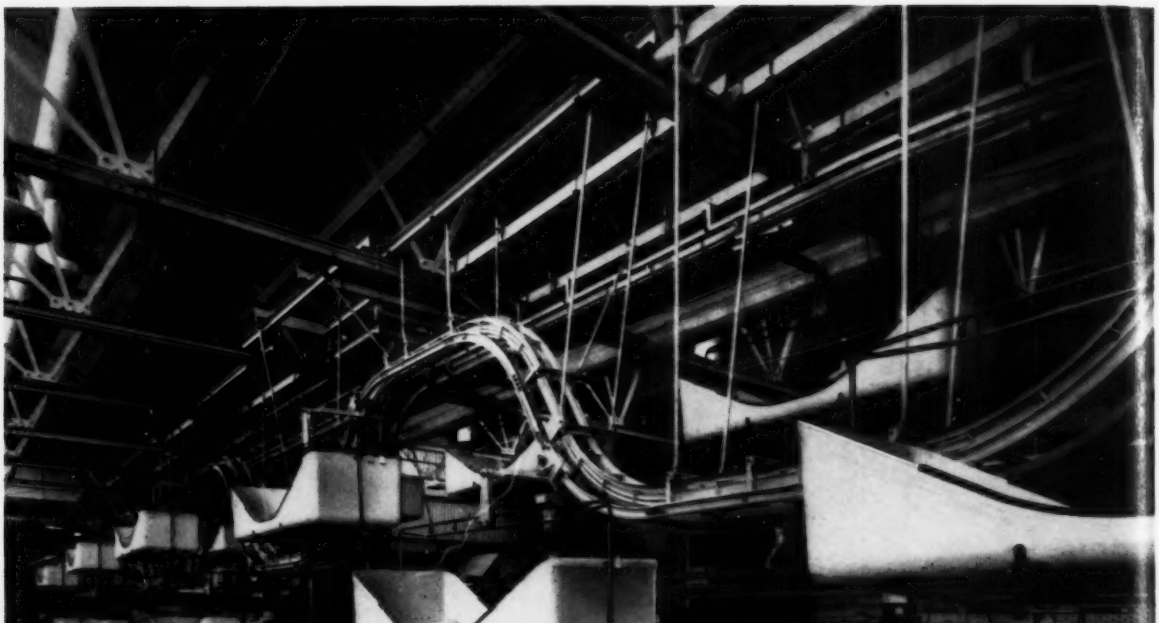


Fig. 5. General view of conveyor system in the No. 3 factory of Triplex Safety Glass Co.

considerable congestion of the floor area. The conveyor has, therefore, not only freed the floor area, but as it runs round a considerable part of the factory it gives the required cooling period. It is, in fact, known as the cooling conveyor.

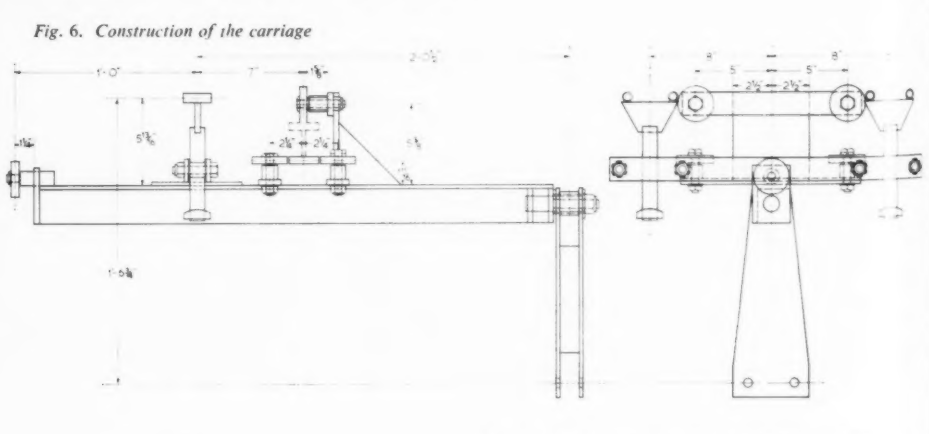
It is driven by two 2-h.p. electric motors through caterpillar drive units incorporating fluid couplings. Its total length is 1,200 ft and the speed of operation can be 15, 20 or 25 ft/min. The minimum cooling time given by the conveyor is 20 minutes.

All rollers, both of the carriages and of the Teleflex chain, are carried on roller bearings packed with graphited grease. The chain consists of links having cruciform ends, each arm carrying a roller, so that each end has four rollers, and these links are joined by plain links to which the triangular top ends of the links propelling the carriages are attached. The chain is capable of negotiating a curve of 6-ft radius, of which there are two at points where the conveyor doubles back on itself.

Glass carriers are of polyester-reinforced glass fibre in a light-weight frame of ¾-in steel tube of 16 gauge. They are manufactured by Dienst, Ltd., and have four pads of epoxy resin with powdered slate as a filler in the bottom on which the hot glasses rest. Apart from their light weight, carrier and frame weighing 32 lb, an advantage is the smoothness of their interior finish, which is easily washable.

The installation includes a main switch panel and a number of emergency stop buttons placed at strategic points, each of which has an indicator light on the control panel. When restarting the conveyor after a stop, a warning bell rings automatically some seconds before movement commences.

Fig. 6. Construction of the carriage



HANDLING WITH INDUSTRIAL TRUCKS

PART 5 — INDUSTRIAL TRUCK UTILIZATION PLANNING

By L. J. Hoefkens, A.I.Prod.E.

THERE is quite an amount of evidence that when industrial trucks are purchased they are not used to the maximum advantage, neither is the increased efficiency or the reduction of personnel being achieved which was envisaged when the proposal and justification for purchase of the equipment was compiled.

Let us consider what does happen so often in actual practice. When a company decides to purchase a machine tool, the placing of the order is preceded by a thorough investigation as to the need, the technical achievement of the machine, its rate of output and what the effect of its acquisition will be on the cost of the product. Subsequently, the production engineer produces an operation sheet stipulating how the machine shall be used and tooling and jigs are designed. Motion study is applied to the job to ensure that the maximum productivity is obtained. Time study then follows to establish the operating cost. An operator is trained for the job and supervision is maintained to see that the standards laid down by these various experts are achieved. The systems department creates documents and routines which enable the cost accountant to check performance and thus by the co-ordinated effort of all these technicians the board of directors is assured that an adequate return on the capital outlay will be made. In other words, the maximum possible brainpower and technological skill which the company possesses is brought to bear on the subject, which is the achievement of the highest degree of productivity from the new machine tool. Now in the case of the purchase of a fork lift truck what happens, unfortunately, so often? After perhaps a considerable amount of discussion someone is persuaded to agree to the purchase of a fork lift truck, because a lot has been talked about it and it is felt that to have one is to be up to date. When it arrives it is looked upon as 'just another truck' and is given over to 'just another driver', and is turned loose in the factory without anyone having very much idea what it is all about.

Why this nonchalant attitude towards what is a most important piece of equipment capable of effecting a considerable reduction in overheads is really difficult to appreciate. Its cost is not insignificant and, therefore, should not be ignored, and yet the management techniques applied throughout the rest of the factory to production equipment fail to be used on such items as fork lift trucks. It would seem right then that a number of specialists should combine together and by the application of their various skills and techniques so plan the use and control of the fork lift truck that its efficient employment is guaranteed.

Firstly, then, the production engineer should decide for what purpose the truck will be used and where it will be operated. A fork lift truck has two functions to fulfil, as a general rule, namely, that of stacking material or pallets and that of transportation. Therefore, the nature of its work must be decided upon and planned, and subsequently the routes over which it will travel.

The next step is for the work and movements to be examined by the method study engineer to plan the finer details and to ensure full co-ordination and elimination of such items as empty running or waiting time. In close co-operation with the latter the time study engineer can establish the price for the job and a piecework price can be calculated or some form of incentive bonus scheme can be decided. A competent supervisor should undertake the training of drivers in the handling of a fork lift truck, and it will be necessary for him to work together with the safety officer to draw up a minimum number of safety rules for observance by drivers. Last, but not by any means least, a preventive maintenance plan must be determined as well as ensuring that facilities are available for a repair service.

In conclusion, the systems department must design suitable routines and paperwork systems to ensure that the movements of the trucks are controlled as well as the movement of the materials they transport; that records are maintained for the compilation of the piecework payment; that records of running costs are established which will show such items as fuel or power used, spare parts consumed and maintenance labour employed. All of these items should be costed to the individual truck. In other words, the same expert knowledge and technological skill which is concentrated on a production function must be brought to bear upon this kind of non-productive service to production if the maximum efficiency is to be obtained by the purchase of modern material handling equipment. Too long have these ancillary functions been ignored and have been left to fend for themselves. They are vital to production; they are capable of effecting tremendous improvements and can make a substantial contribution to the lowering of the end product cost by a reduction in overhead rates. As a rule, the means to achieve these ends are available but are not deployed for this purpose.

Practical examples

Some practical examples to illustrate these principles will now be given as a guide and to indicate the type of planning that should take place. Works trucks and particularly fork lift trucks can usually be divided into two broad categories from a work application point of view.

Firstly, a fork lift truck can become part of the factory general internal transport service, that is, it will transport and stack non-routine loads around the factory. Secondly, a fork lift truck can be an integral part of a stores function. It will become the new method of handling stores. In this case the storeman has become 'mechanized', his sack truck or hand-operated hoist has disappeared and has been superseded by the fork lift truck, but the mechanized

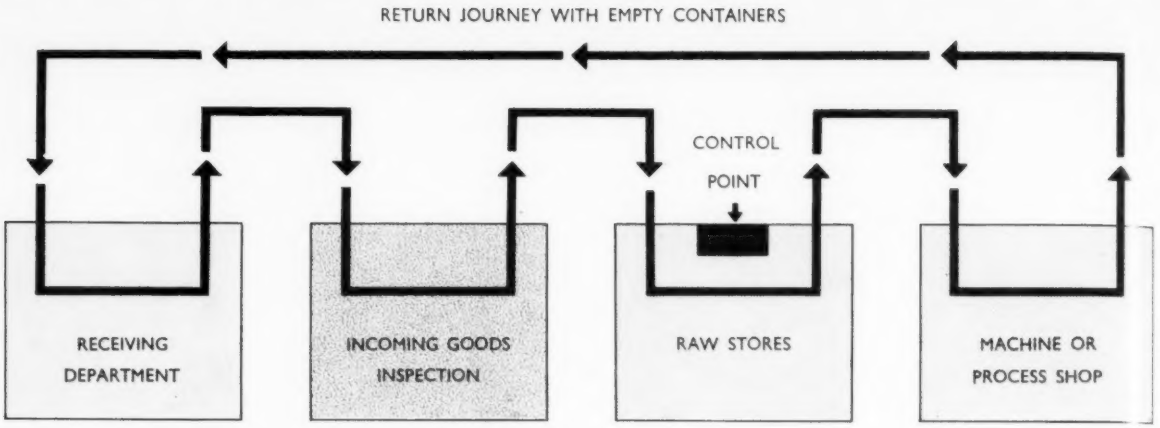


Fig. 1. Schematic diagram of fork lift truck movements from reception of material to first operation

storeman has the same responsibilities as before for the receiving, locating and issuing of stores. The only difference being that now he does it so much more efficiently by using a fork lift truck instead of a hand truck, sack truck or hand-hoisting mechanism.

Let us first assume that a raw material or rough store has been changed over from bins, racks and floor stacks of materials to a store consisting only of pallets and that they will be handled by two fork lift trucks. The new mechanized storemen have the duties of receiving the palletized loads into the store, locating them in the various rows and pallet stacks, and subsequently making issues to the producing machine shops. Under the old methods of handling and transporting it is often found that the storemen's activities are restricted to the confines of the store itself and that another department would bring material to the store and that internal transport would take away and deliver any issues. It now makes sense and also speeds up the movement of material if the mechanized storeman, once he has the pallets containing the issue of material on his fork lift truck, delivers them to their destination which usually will be the first machining operation rather than depositing the load at the exit of the store where it would have to wait for an internal transport truck to collect it. This new outlook ensures that the stores gangways are always kept free of containers, no abeyance areas are required in the store and the issue is made promptly to the place where it is required. The work study engineer will then point out that the truck will be returning from such journeys in an empty condition, which constitutes an inefficiency, so it seems reasonable that the driver should bring back empty containers for refilling with material. Not always will a full load of empties be available just when he arrives but usually more empties can be carried by the fork lift truck than full ones if the truck is driven in reverse, so that the driver has a safe and clear vision of his route. On average, the truck should be capable of clearing as many empties in a day as he delivers of the full ones.

Prior to the first machining operation the movements of material are:

(1) Unloading and checking of incoming supplies and placing in pallets.

(2) Stacking pallets in the reception area whilst domestic paperwork is prepared.

(3) Movement of pallets to a receiving inspection department.

(4) Movement of pallets after inspection is completed into the raw or rough stores and placing in pallet stacks.

(5) Issuing of pallets upon request by the machine shop progress section to the first machining operations.

(6) Removal of empty containers from the machine shop back to the reception department.

An efficient service can be given to each of these stages of movement and the capacity of the trucks can be utilized to the maximum if a principle of truck routing is adopted. In order to make this effective a control point is set up on the corner of the main gangway by which the trucks have to pass in carrying out these duties and is located centrally in the round tour of the trucks. The sequence of the truck movements is as follows, Fig. 1:

(1) Pick up a full load, i.e. two standard 1-ton containers in the reception area, and place in the inspection department.

(2) Whilst in the inspection department pick up two containers of material which have been passed by inspection and take to the raw stores and stack away in a location.

(3) Whilst in the store remove from the stores stacks two containers and take to the machine shop or processing department.

(4) Whilst in the machine shop pick up a load of empty containers and bring them back to the reception area via the control point where a fresh set of instructions would be handed to the driver.

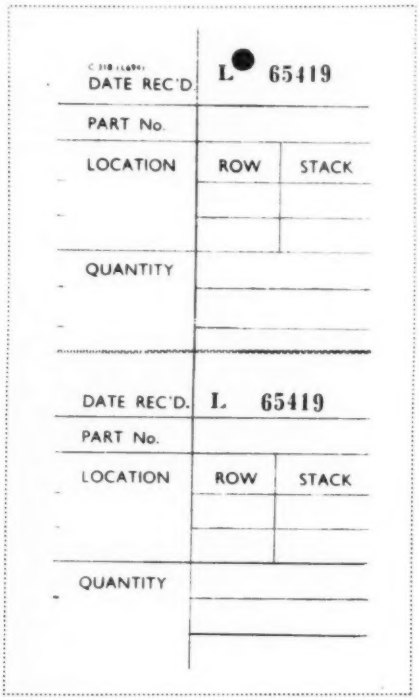
As material is checked in at the reception point and is put into containers or on pallets a tally is fixed to each container or pallet. This tally is in two identical halves and is perforated in the centre, Fig. 2. Each half is printed with spaces for identical information, namely, date of receipt, part number or stock number, quantity and stores location reference. A serial number is printed on each half exactly like a cheque book or a postal order so that if any written information becomes illegible for any reason the two halves can always be identified. At the reception point when the two halves of the tally are fixed to the container the checker fills in the date of receipt, the part number and the quantity in the container. At this stage the stores location reference is left blank. After inspection, a fork truck will bring, as was stated before, a batch of material, two containers at a time, together with the domestic goods inwards note endorsed by an inspector, into the raw stores. He will place the containers in any empty space in any row of stacks. At this point the driver will add the location information to the two halves of the tallies, that is, the row letter and the stack number. He will then detach the bottom halves of the tallies, leaving the top halves attached to the containers, and will return these half-tallies with the inwards note to the movement control point. The movement controller will

check to see that the quantities on the tallies add up to the total of the inwards note, thus ensuring that the total batch has been received into the store. He then files the tallies in a filing cabinet under part number order. The file has thick dividing cards stamped with a part number for each item carried in stock. These cards are in numerical rotation and the tallies of any one part number are filed behind the appropriate divider. They are also filed in date order sequence, the oldest tally in the front. By this method, of random storage of containers, is ensured that the cubic capacity of the store is utilized to the full. While one space remains vacant the store is not full.

The movement controller will also receive a continuous stream of requisitions from the manufacturing divisions calling for material to be delivered to a machine line or a process shop. He then extracts from the file tallies to meet the quantities of each part number called for. The tallies corresponding to the containers which first entered the store are extracted first, i.e. the foremost tally behind each subdivision. Thus, in this manner the oldest material is always used up first and a correct rotation of stocks can be achieved. A fork lift truck driver by reference to the location information on the tally can proceed directly to the required containers and take them from the stacks and deliver them to their destinations. He also detaches the half-tally attached to the container and hands both halves in at the control point. This signifies to the movement controller that the correct material has been issued and, the job having been completed, the two matching half-tallies are placed in a dead file.

All this paperwork and information flowing to the movement controller at the control point enables him to build up his routes and to control his fork lift trucks or mechanized storemen effectively. He receives information from the reception point that batches of material are ready to be moved into the inspection area. He is also advised that batches have been inspected and are available for the raw

Fig. 2. Tally, one half of which is attached to the pallet or container, the other half, identical with the first, being filed by the movement controller



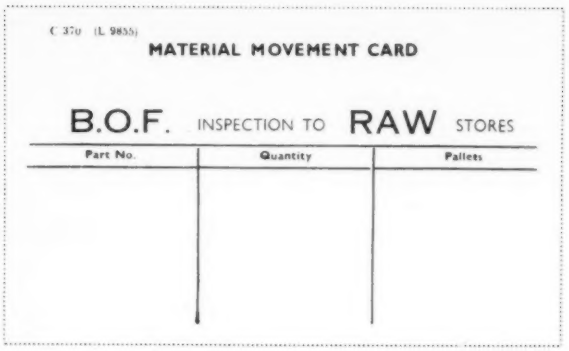


Fig. 3. Material Movement Card

store and, finally, the requisitions to deliver material from the stores to the machine lines or process shop.

For each stage of movement he has a small card, 5 × 3 in, each stage having a distinctive colour, Fig. 3.

(*a*) Receiving to inspection..... Buff
(*b*) Inspection to raw store..... Yellow
(*c*) Raw store to..... Blue
(*d*) Empties to receiving..... White

The card is headed with its description 'Material Movement Card' and then in large type with the movement stage description, i.e. 'Receiving to Inspection'. Then provision is made for the part number, quantity and number of containers or pallets. The number of pallets should never exceed the safe load of the fork lift truck so that there may be several such cards to move an entire batch of material. There is also a pink card which has a heading merely stating 'From..... To.....'. This blank card is used by the movement controller for movements which fall outside the normal routine route. An example of this would be, for instance, a batch of material rejected by the inspection section and which would then have to be transported to the despatch section for return to the original supplier. The movement controller has a number of metal plaques, each to hold four movement cards. There are four slides to hold the cards so that they are displayed one below the other. The plaque is 6 × 12 in and has a hook fixed to it at the top. In the plaques are placed the coloured cards in the sequence of the round route as described. On the card marked 'Raw Store to.....' is filled in the destination and two half-tallies are slipped in on top of the card. These tallies will correspond to a requisition to deliver material from the store as described earlier on. When the controller has compiled a route the plaque is hung up on a rail over the control point, where the fork truck driver can reach one as he passes. The driver will take the first plaque and hand in a completed one at the same time. Priorities can easily be changed by switching the rotation of the plaques. On the back of each plaque is a metal pocket for the transport of paperwork, which can be handed to the driver for delivery to the movement controller. This saves unnecessary walking about. In this manner the movement controller has strict control over the work of the fork lift trucks, which obviously are calling on him at very regular short intervals all through the day. This enables him to make promises with reasonable accuracy.

So far, then, the work of the fork lift trucks has been defined and by work study the efficient running over laid-down routes is assured. The systems department have designed the forms, tallies and movement cards to enable the scheme to function. After these methods have been operating for some months and have been proved, and any small adjustments made in the light of actual experience,

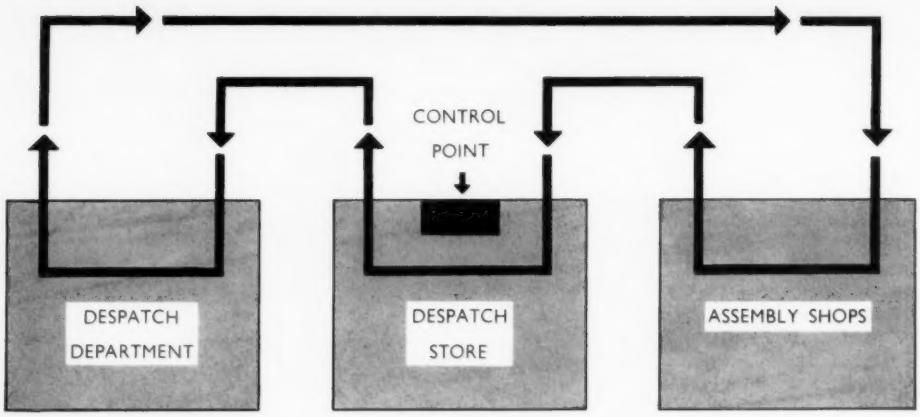


Fig. 4. Schematic diagram of fork-lift truck movements from assembly of finished product to despatch

the time study engineers can commence their work to introduce a piecework or bonus incentive scheme.

It will be appreciated from the foregoing descriptions that a point has now been reached where we have a standard load, i.e. the maximum safe load transported over standard distances by a standard machine. Consequently it was not a very complicated task to fix a time for each standard movement of material. Such details as slight differences in distances travelled, as between, for instance, the store and one machine line or another, can be ignored, also the smaller differences between various stores locations. Observations over a period of time make it possible to arrive at a fair average value. This means then that a price can be given to each category of material movement cards and that as routes are completed and the cards handed back to the movement controller they can be filed in boxes under the fork truck driver's name. At the end of the week the compilation of the individual driver's bonus is quite simple. A total of each colour of card is given to the wages department against the driver's name and the calculation then becomes one of time taken against time allowed by reference to the driver's clock card, and it should be pointed out here that in establishing the allowed time, a safe working speed is used which may not be exceeded for obvious safety reasons. The administration of the piecework scheme has not created any additional clerical effort. Finally, it is necessary for maximum efficiency to ensure that the trucks are available for as many working hours as possible by establishing a preventive maintenance timetable and seeing that it is rigidly adhered to. A recording system is commenced so that the truck-running efficiency can be studied by management, as well as the operating costs. Each truck has painted on it in a prominent position a serial number by which it is henceforth known and identified. It is supplied with a log book in which is recorded any fuel drawn by the truck in the case of petrol- or diesel-engined machines. The working hours are also entered in the log book, which should correspond with the driver's clock hours less any downtime of the truck for repairs or maintenance. The driver records also any repairs carried out and the length of downtime and obtains the signature of the maintenance foreman against the entry. From this information record cards of the downtime and causes can be kept for each individual truck. Maintenance labour and spare parts are booked on a job card against the truck number. Thus a complete and comprehensive record can be kept of the running efficiency of each truck and of its operating cost.

A prospective fork lift truck driver should undergo a set predetermined number of exercises and should be able to perform these satisfactorily before he is permitted to enter the works and to operate in a store amongst other people. The works safety officer should compile a set of essential safety rules applicable to the peculiar conditions of the factory concerned and these should be explained to each and every driver.

It will be seen that there exists little or no difference between the principles involved in dealing with the acquisition of a new machine and its introduction into a factory, and a fork lift truck. For maximum efficiency they should both be the subjects of the same management techniques.

A further example of the use of this principle of truck-routing, after work study has been applied to the job, is at the opposite end of the production cycle, namely the handling, storing and despatching of the finished products. In this instance, again, there are mechanized storemen in the despatch store who make use of fork lift trucks to receive, locate and issue pallets of finished goods. Previously they manhandled this material into and out of bins and built and dismantled stacks on the floor aided by hand trucks for local transportation. Issues from the store were taken by small petrol trucks of the internal transport service to the despatch bay where the goods were off-loaded by hand and stacked on the floor. Subsequently they were loaded manually on to lorries by means of some five or six men forming a chain and handing the goods on from one to another. Now that fork lift trucks are used and the material is handled in pallet loads, the mechanized storemen are no longer restricted to the confines of the store but, as in the previous case of the traffic in and out of the raw store, they now extend their activities to the collection of the material from the assembly shops and receive it in the store, stacking it in a stores location and later delivering it to the despatch deck.

The stages of movement will be as follows (Fig. 4).

(1) Placing material and counting it into pallets after final inspection at the end of the assembly conveyors.
(2) Movement of full pallets to the despatch store and placing in pallet stacks.
(3) Issuing of pallets of material upon receipt of despatch instructions from the sales department and stacking them in the despatch bay.
(4) Removal of empty pallets from returning vehicles after having made a delivery to a customer and taking them to the assembly conveyor.

A control point is set up in a convenient spot along the route past which the fork trucks, operating from the despatch store, have to travel. The movement controller functions along the same lines as already described, but in this case he receives his issuing instructions from the sales department advising him which pallets to despatch to a customer. He also compiles his fork truck routes by means of coloured cards for each movement and inserts them in plaques for handing to the drivers as they report to him for the next job to be done. The cards are as follows:

(*a*) Assembly shop to despatch store..... Buff
(*b*) Despatch store to despatch deck..... Blue
(*c*) Empties to assembly shop..... White

Again, these cards, which represent a standard load

transported over a standard distance by a standard machine, can form the basis of a piecework payment scheme.

By mechanizing storemen and arranging their duties and the movement of fork lift trucks in this manner the largest part of the volume of material to be moved can be dealt with. It now leaves a balance to be organized which will consist in the main of movement of material not directly connected with the function of receiving, storing or despatching and the movement of non-routine loads. This work is the function of the internal transport section. A movement controller, operating from a control point situated centrally or wherever the greatest incidence of traffic occurs, plans and co-ordinates the work of such trucks under his control in the following manner. An individual with the necessary authority, and usually this will be a member of the progress department, can contact the movement controller by telephone and will request a service. He must give details of the load to be moved, its destination and from where it is to be collected. The controller will then originate a serial-numbered piecework ticket which will repeat this information. Each member of the progress department is provided with a book of blank piecework tickets and he can also originate them himself and can hand them to any driver. The driver will not, however, perform the work but will hand them into the movement controller as soon as he has completed the work he is doing and reports back to the control point for the next job. Each truck driver, whether he drives a platform truck or a fork lift truck, can be paid on an individual piecework basis. When the work study engineers study this section, several months may be necessary in order to ascertain precisely what takes place. Eventually, it will, no doubt, be concluded that the loads to be carried can be categorized under several headings and each can be given a reference number. It may also be decided that the computation of payment can be simplified and the administration cost of the scheme kept to a minimum if the journey distances can be ignored. It is assumed that as the jobs are mainly of a non-routine character and that work is given out to any driver, each man will perform a mixture of short runs and long runs each week. In practice, this usually works out satisfactorily. A standard journey allowance is calculated. In addition to this it may be found that a standard time allowance can be fixed for a few jobs which occur each shift or each day, but these are not always allocated to the same driver. The system would function as follows. The movement controller assembles the piecework tickets which flow to him, together with those originated by himself in response to telephone requests, into routes of short duration. He tries to organize a route as efficiently as possible to reduce empty running. In other words, where he can, he will give a driver a ticket to pick up a load close to the dropping point of a previous load. Routes are made up of short duration so that drivers will not be away for too long a period from the control point. This enables the controller to make a promise to meet an urgent request for transport with accuracy. The drivers when delivering a load obtain the signature, on the piecework ticket, of the recipient in the area. This will be either a foreman or a progress man and the signed tickets are handed back to the movement controller upon completion. The movement controller codes each ticket with the code number of the type of load carried in accordance with the work study schedule and books the ticket, on a daily summary sheet, to the driver who performed the work. In addition, the driver is credited with the standard journey allowance for each ticket handed in.

These sheets are sent to the wages office where the bonus is computed on the basis of time taken against time allowed. In this manner, therefore, by the establishment of control points manned by movement controllers and simple paperwork systems, all transport can be organized and controlled with maximum efficiency. Trucks are not at everyone's beck and call, neither are drivers allowed freedom to roam about, but each movement is planned and controlled and paid for on a basis of reward for effort.

Summarizing, then, the key points can be stated as follows:

(1) A fork lift truck is an important piece of equipment

Fig. 5. Interchange trolley being brought to the fork lift truck by means of a tug-lift attachment

Fig. 6. Locating hooks being placed in position

Fig. 7. Discharged battery being pulled out of truck on to interchange trolley

Fig. 8. Positioning fully charged battery on interchange trolley by means of tug-lift attachment

Fig. 9. Interchange trolley with fully charged battery being lined up with trucks prior to pushing it into the battery compartment

with a great cost-saving potential and is not 'just another truck'.

(2) It is capable of stacking material and, in addition, is a means of transportation.

(3) It can be employed as a mechanical aid for storemen.

(4) It can be employed as a means of internal factory transport.

(5) Because of this, the skill and techniques of management specialists should be used and co-ordinated when introducing a fork lift truck to ensure maximum efficiency and an adequate return on the capital invested.

(*a*) The production engineer should plan its work and its routes.

(*b*) The method study engineer should ensure maximum utilization of machine and driver.

(*c*) The time study engineer should establish the operating price and devise an incentive scheme.

(*d*) The transport supervisor should train the operator who must not be 'just another driver'.

(*e*) The safety officer should compile adequate safety regulations.

(*f*) The maintenance supervisor should plan a preventive maintenance scheme and an efficient repair service.

(*g*) The systems engineer should design suitable paperwork and routines; to control the movement of truck and material, to provide figures for the incentive scheme and information to establish running costs.

Battery Charging and Changing

More and more industrial trucks powered by an electric battery are being used for reasons already stated. This applies particularly to fork lift trucks of all kinds, both rider- and pedestrian-controlled. Unlike the petrol- or diesel-engined truck which can replenish itself at a fuel pump and be back on the job in a few minutes, the electric truck has to rely on the charge or amount of energy which has been stored in its battery. Although a battery has no moving parts, it is, nevertheless, a vital component of the truck, subject to wear and deterioration and therefore in need of special care and understanding if it is to operate efficiently and run its full life. It is perhaps because nothing much can be seen or heard to happen in batteries that they are so frequently incorrectly treated, resulting in a premature breakdown, and are consequently condemned as a source of motive power. A large industrial truck battery is an expensive item, but full value for money can be obtained if the maker's instructions and recommendations are rigidly adhered to. It is the result of many years of research and is designed to stand up to hard wear under the right operating conditions. As such they are guaranteed by all reputable manufacturers for four years. During this period of guarantee, service engineers make regular visits to check batteries and to report to their owners on their condition, to replace cells found to be defective under the terms of the guarantee and to give advice on their treatment.

A battery in itself is a simple piece of equipment which, contrary to popular conception, does not actually store electricity. It stores chemical energy, which is converted into electrical energy during discharge. When the battery is recharged by connecting it to a source of direct current the electrical energy changes the active materials back to their original condition, thereby restoring the chemical energy for a further discharge. There is therefore a complete cycle of charge and discharge which is the fundamental of its operation and its life.

To enable the chemical action to take place during the charge and discharge cycle a liquid is present in the battery. This liquid consists of sulphuric acid and distilled water and is known as an 'electrolyte'. The effect of charging the battery is to raise the specific gravity of the electrolyte and, conversely, it is lowered when discharging. By using an hydrometer to test the specific gravity the condition of the battery and of individual cells can be checked at any time.

When a battery is fully charged the specific gravity will be of the order of 1·280. The third decimal place is known as 'a point'. It is usually recommended by the battery makers that the specific gravity should not be allowed to fall more than 100 points, at which stage the battery should be recharged. This drop in specific gravity is directly proportional to the number of ampere-hours given up by the battery.

While charging and discharging, a battery generates heat; excessive heat can have a deleterious effect on the chemical constituents on the plates in the battery. A battery should not be allowed to get too hot and therefore a cooling period is advisable between the beginning and end of a complete cycle. It is for this reason that a stipulation of the guarantee lays down that a battery should only be subjected to one complete cycle in a 24-hr period. This is a very important point.

The determination of battery capacity required to perform a certain task can be done by reference to tables and charts which can be obtained from truck manufacturers. In the case of fork lift trucks it is known what power is required to carry out the individual jobs a truck can do,

i.e. carry a 1-ton load for 250 yd, raise a 30-cwt load up to 8 ft, tilt back and forward, etc. However, other factors play a part, such as the nature and condition of floors and particularly the effect of any gradients the truck has to negotiate. Although a truck may be purchased for a series of planned operations in a factory, in which case such calculations can be made and a suitable battery capacity estimated, nevertheless it is usual to find in practice that conditions vary considerably and that in addition extra hours are worked. Furthermore, as drivers become more experienced or are paid an incentive bonus, additional work is undertaken. All of this means a greater drain on the battery than was anticiapted, with the result that the battery will eventually not last for the calculated work span and that the electrolyte has dropped its 100 points in specific gravity before the end of the shift.

The safest way to ascertain the true requirement is by practical experience on the job under actual working conditions. At least it is certain that one battery and one charger will be required, so that with this minimum equipment, tests and checks can be undertaken. Having made sure that the battery is fully charged, put the truck to work and then take specific gravity readings, say, every 2 or 3 hours during the day, and record the results, noting also the type and nature of the work performed. In making these checks and calculations it should be borne in mind that it will take approximately 1½ times as long to charge a battery as to discharge it. This means that a battery which will have reached its maximum recommended discharge point at the end of an 8-hr shift will require about 12 hr to restore it to its correct working condition. Under the same operating conditions, if a larger capacity battery was required to work for a 10-hr period, about 15 hr would be necessary to recharge it and consequently it would not be ready in time to commence the next day's work. Where the initial checks show that the battery will comfortably perform the day's task, then of course the battery can be charged in the truck during the night. On the other hand, if it is found that the recommended maximum specific gravity drop has been reached after, say, 5 hr, then the battery must be exchanged for a fully charged one. In this case two batteries are required and one charger. In similar circumstances, should the truck have to work during a day and night shift it will no doubt be found that three batteries would be necessary and two chargers.

Battery Changing Routine

In factories where these sort of conditions apply it is not practicable to have someone continually checking specific gravities and thereby impeding the work of the trucks. A planned routine for changing batteries should be organized in the following manner which will make the operation automatic. If, for instance, six trucks are involved, then specific gravity checks should be made for a period of a few weeks under working conditions. A time can then be found, which can be laid down as an instruction, for all trucks to report to the charging station to have their batteries changed regardless of their condition. This means that none may be below the 100 point drop in specific gravity, but some may be above it. Although some may not be fully discharged on certain days of the week, which will depend on the work done, the changing of batteries will be on an organized basis and the correct recommended charging procedure will be observed. Experience has shown that under controlled working conditions of this nature it is possible to exceed the guaranteed life of a large industrial truck battery by as much as two years, giving a six-year life in all.

It is customary nowadays to provide a separate charger for each battery to be charged. The chargers are of the static type having no moving parts and are silent in operation. They can be wall-mounted and should have adequate ventilation to ensure that they are kept at a minimum temperature. By having individual chargers, as opposed to a single charging source, one is insured against a complete stoppage as a result of a breakdown. Further, modifications to the charging room layout are simple and inexpensive to make.

As stated earlier on, where one battery only is required, it can remain in the truck whilst being recharged; however, where batteries have to be changed special equipment is needed to make this operation safe, simple and speedy. The batteries are very heavy and must not be roughly treated so that some means of handling them efficiently is essential.

It was the custom to use an overhead runway with a hoist to lift the batteries in and out of the trucks and to manipulate them in the charging station but this method has several drawbacks. It is rigid and not easily adaptable to changing layout requirements. The benches and roller tracking that are required with it take up space. Protection must be provided to ensure that metal parts of the hoisting equipment do not damage or short-circuit the battery.

A simpler, more flexible method has been developed and that is to mount the battery on rollers or wheels and to slide it on to a small trolley. This method is adequate for the smaller capacity hand- and pedestrian-operated trucks. Where larger batteries are involved an excellent method is the following.

The battery is fitted with what is called an 'interchangeability feature', being an angle-iron framework supported on four grooved wheels running on two rails. The driver brings a special battery trolley to the truck, Fig. 5. This trolley is a steel framework on two legs and two wheels and is moved by a *Tuglift* towing handle inserted in a *Tuglift* socket on one end of the trolley. The towing handle is then depressed which has the effect of raising the two trolley legs off the ground. The trolley can then be moved about on its own two wheels and steered by the pair of wheels at the base of the towing handle. The battery trolley is positioned beside the battery compartment and is locked to the truck by two locating hooks. These hooks ensure that the rails of the trolley are in line with the rails on which the battery

Fig. 10. *A view of a battery charging station at Lockheed Hydraulic Brake Co., Ltd., using the interchange trolley system for battery changing*

'interchangeability feature' rests and forms a bridge between the two, Fig. 6. The trolley is fitted with small rubber bumper wheels which project and contact the side of the truck and prevent scratching of its painted surface.

The battery can now be pulled out of the battery compartment on to the trolley by means of handles on the sides of the battery box, Fig. 7. Two safety sprung locking latches fixed to the trolley are swung over two of the wheels on the 'interchangeability feature' so that the battery is locked in position on the trolley. The locating hooks are raised and the discharged battery is free to be taken and connected to its own charging source.

A battery that has completed its recharging, having been disconnected from its charger, is now brought to the truck by means of the same *Tuglift* handle, Fig. 8. The trolley on which the battery stands is lined up with the truck by means of the locating hooks. The safety locking latches are raised and the battery is pushed on the rails into the battery compartment and connected up, Fig. 9. The truck is then ready for service again. Although one man can perform this entire battery changing operation it is very much quicker and easier if several trucks come in to change together. If the battery changing has been organized at fixed intervals as recommended then two, or at the most three, trucks, depending on the available manœuvring space, can report together. By working as a team, three trucks can be changed in about 7 min.

The battery-changing trucks are also fitted with a loose handle by means of which the battery carrying platform can be raised or lowered. It is essential for this feature to be incorporated to ensure that not only are the rails of the trolley and of the battery compartment in line but that they are also level when they meet. Owing to the weight of the battery a slight unevenness at the joint would make the moving of the battery very difficult. An uneven floor or tyre wear on the truck will make a slight adjustment necessary from time to time.

It will be appreciated that if battery changing is contemplated then every battery must be fitted with an 'interchangeability feature' and each additional battery must have its own charging trolley. However many batteries there are only one spare empty trolley is required for each charging station. If battery changing is not needed at the outset but is envisaged in the future, arrangements should be made to ensure that adequate space is available in the truck's battery compartment for rollers or an 'interchangeability feature' to be fitted later on, Fig. 10.

Another manufacturer has fitted to a 2-ton reach truck a light removable jib attachment by means of which the truck can lift out or replace its own batteries by raising or lowering its forks and using its own power. In this case there is a very positive need not to discharge the battery completely.

Finally, a very important advantage of these flexible and mobile methods of changing batteries is that a battery may be removed anywhere in the works if say, in case of a breakdown, a truck cannot get back to the repair shop or charging station under its own power. It could be either that a freshly charged battery is needed or that access is required to a component obscured by the battery in the truck.

For very heavy batteries this method is not suitable and overhead tackle must be used. It is quite satisfactory for trucks up to a lifting capacity of 2 tons.

£1,000,000 Refinery at Greenock

A GREAT possibility that Scotland's oldest sugar refinery would have had to close, had not bulk-handling facilities been installed at Greenock was announced recently by Hugh B. Walker, director of John Walker & Co. (Sugar Refiners), Ltd. Mr. Walker was speaking at a luncheon in Greenock given to mark the completion of the company's £1,000,000 scheme of reconstruction and modernization. 'The introduction of bulk-handling has led to a very sharp drop in the number of men needed to unload raw sugar and ships can be cleared of their cargoes in less than half the time previously taken', he said, 'but these were secondary considerations in arriving at our decision to go in for bulk-handling.

'By far the most important was that unless we did so it was very possible that in a few years' time we should have been forced to close the refinery altogether. All the sugar-growing areas of the world have or are about to have bulk-loading facilities, and it is going to be practically impossible to obtain a steady supply of bagged sugar. It is obvious that if we could not obtain bagged sugar and we could not handle sugar in bulk, then the local industry would die, Greenock would cease to be a refining port and more than 1,000 people would have been thrown out of work'.

During the past six years, without interrupting production, rebuilding, modernization and the installation of new plant has continued. What stands to-day is virtually a new refinery, the major exception being the char house—and that will almost certainly be re-built and re-equipped within the next two or three years.

Designed and equipped to operate at the highest pitch of efficiency, the Greenock refinery is now among the most modern in the world. A number of the processes are almost fully automatic. Among its new features are a silo capable of storing 5,000 tons of raw sugar, fed by twin elevators, each 135 ft high and each able to handle 100 tons per hour; a recovery house using the most up-to-date machinery; and automatic centifrugal machines which rotate at 1,100 revolutions per minute compared with 750 r.p.m. achieved by those which have been discarded.

Possibly the biggest single improvement has been the introduction of bulk-handling at the James Watt Dock, which has revolutionized the landing of raw sugar at the Port of Greenock. To do this three travelling cranes, each fitted with 2½-ton grabs, and three 25-ton mobile hoppers were installed at the Dock. A fleet of specially-designed tipper trucks was created to carry the sugar from the hoppers to the refinery.

Among the results have been an 80 per cent reduction in the number of men required at the Dock, unloading has speeded up so that 9,000 ton cargo can be cleared in 40 working hours instead of 96, and it can now continue in all weathers whereas in the past, heavy rain or snow led to expensive stoppages. At the refinery itself, unloading squads of 12 or 14 men have been replaced by two silo attendants.

John Walker & Co. recently introduced a system whereby refined granulated sugar is carried in bulk and delivered to customers pneumatically, the first company in Britain to do so it is claimed. This has not only the advantage of greater cleanliness in handling, but reduces packing material costs and means a saving of labour both to the refiner and to the customer, and also saves the customer the cost of expensive receiving plant.

50,000 lb. CAPACITY STACKING CARRIER

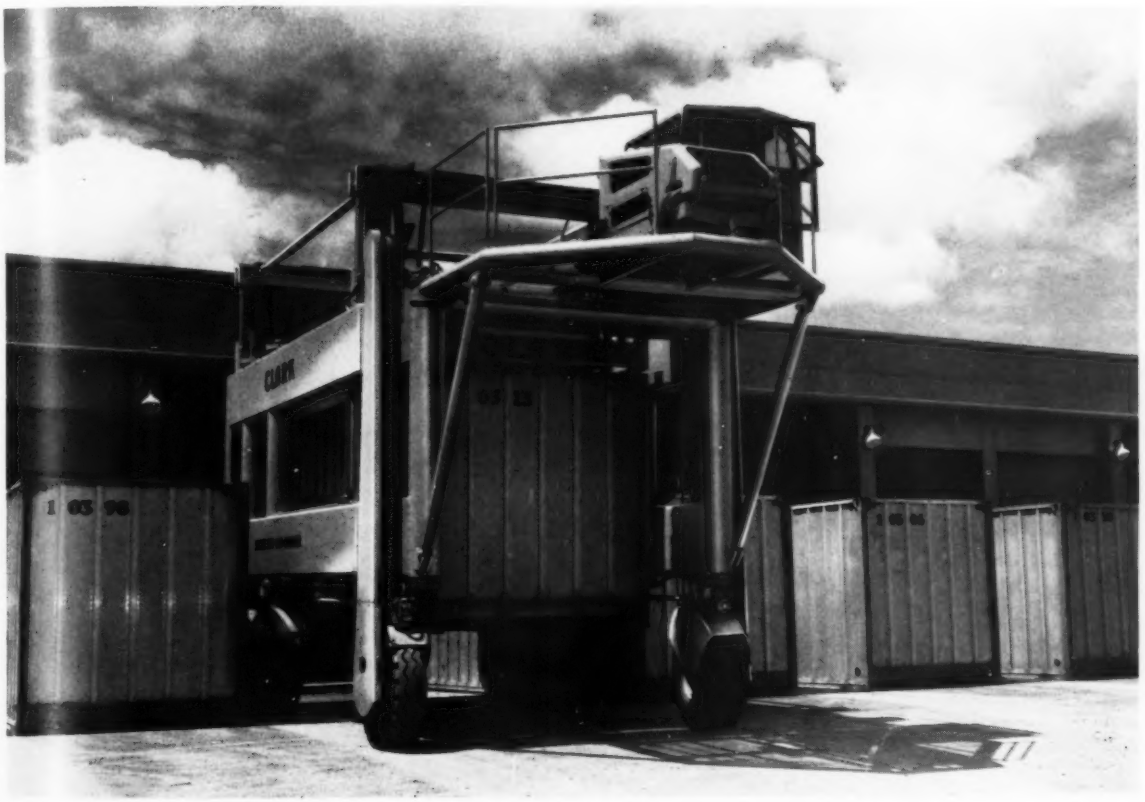


Fig. 1. Only 3 ft clearance is required for each wheel track

The series 500 van carrier introduced by the Industrial Truck Division of the Clark Equipment Co. was developed to serve the handling requirements of the rapidly expanding large shipping container users in the U.S.A. As more and more of these large shipping containers come into service handling requirements at transfer terminal, rail, marine or roadway are tending to increase to a point where conventional handling machines will not adequately serve the problem of movement of the containers within the terminal area.

Such was the case with Cahu Rail and Land Co. in Hawaii, who perform the stevedoring operations in Honolulu for the Matson Navigation Co., container ship service between the west coast of America and Hawaii. The Matson containers, which are 24 ft long by 8 ft wide and 8½ ft high, are moved from the dockside in Hawaii by narrow-gauge rail wagons to a marshalling area inland. The containers on the rail wagons are stored in 10 and 20 units of cars on parallel rail sidings, which allows about 3 or 4 ft between rows of containers on cars. The problem facing C. R. & L. was to be able to pick up any container in these units of cars, carry it to a waiting truck or trailer for delivery to a local consignee, without switching cars.

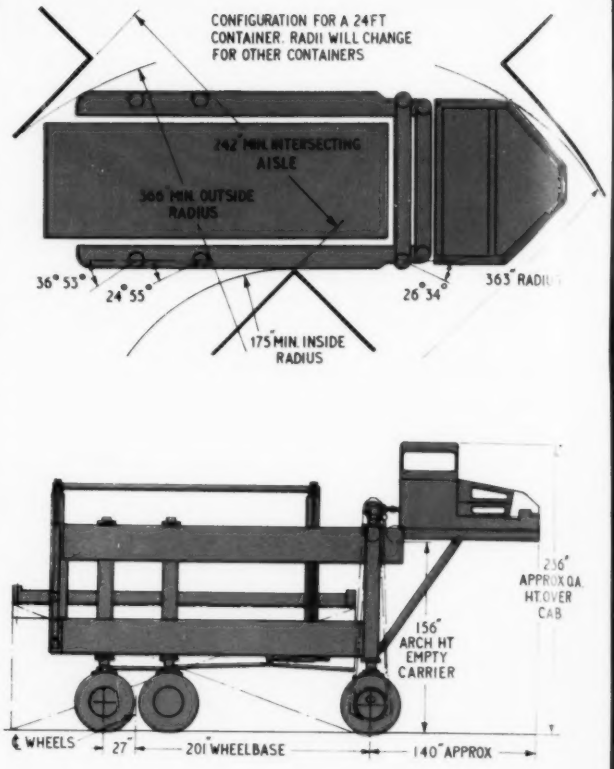
A large lift truck application was considered and discarded because of the large aisle width requirements. This meant acquiring more land, which was not available, or giving up rail track area which was utilized to 100 per cent for storage. A straddle carrier was considered but as a lift arch of 22 ft would be required to carry an 8½-ft box over another 8½-ft box on a 3½-ft rail wagon with minimum

clearance, the total overall height of such a unit would approach 29 ft. Overhead clearances as well as stability and drive train problems in such a high unit caused rejection of this type of unit.

At this point it became obvious that a handling machine which had the horizontal load carrying advantages and the 'straddle ability' of the carrier, and the low overhead clearance and stacking ability of the lift truck, would be the solution. It was for this reason that the stacking carrier came into being: a carrier which lifted through itself rather than underneath itself, a straddle carrier which could lift its load higher than itself.

By applying the capabilities of the stacking carrier to other large-container handling operations additional advantages were determined, such as the relatively low wheel loading encountered, compared to a lift truck operation.

A device of this description is very much a question of tailor-made engineering, and as a rule the customers' special requirements have to be built into the units. For this reason I.T.D., Ltd., who are agents for Clark Equipment, will not be producing the equipment in Great Britain, although they are prepared to investigate any requirements of prospective users and handle the matter in association with Clark Equipment.



RIGHT
Fig. 2. Drawing showing overall dimensions and turning clearance for the Series 500 Van Carrier

BELOW
Fig. 3. Showing how one container can be lifted over another

Fig. 4. Depositing container on a rail wagon

The series 500 van carrier is powered by a heavy-duty truck-type petrol engine, or diesel. A Clark heavy-duty torque converter, hydraulically operated, is fitted. This utilizes wet plate clutches hydraulically locked for power output to the transmission gears. A heavy-duty truck-type selective synchronous transmission with five speeds forward and reverse is used, with constant mesh helical gears in the upper four speeds.

Telescoping splined shaft-type universal joints equipped with high capacity needle bearings are used to connect the engine differential and drive sprockets. A $1\frac{3}{4}$-in pitch A.S.A. roller chain is used for the chain drive.

A six-wheel two-shoe internal expanding heavy-duty hydraulic brake system is fitted, $17\frac{1}{4}$ in dia by 4 in, with 2-in dia wheel cylinders. The brakes are operated by a tandem vacuum power brake cylinder and master cylinder with a large tank for vacuum reserve. For emergency braking there are two $14 \times 3\frac{1}{2}$-in mechanical brakes mounted on each side of the differential.

Each wheel is individually suspended on two interchangeable alloy shot peened coil springs. Springs are lubricated and are fully enclosed within the fork tubes. The weight of the machine and its load are carried on a special large-diameter radial thrust bearing in each fork tube corner. The wheel forks are of cast steel hollow-box design of open side construction to give maximum wheel angularity steering radii and accessibility to tyres. Heavy wall seamless steel fork tubes are detachable from the forks and fully interchangeable.

The Clark-Ross 6-wheel Radi-Arc hydraulic power steering with heavy-duty cam and roller-type steering gear fully enclosed and running in oil is claimed to provide effortless steering and extremely small turning radius.

The load and lift frame is hydraulically hoisted and guided at four points within the carrier frame in roller mounted uprights similar to the uprights on a fork lift truck. The hoist system is fully utilized with torque tubes and roller chain.

The carrier is equipped with a rectangular lift frame which has hook-type latches at each corner which are hydraulically actuated. The latches engage a pocket on top of the container so that the frame can be accurately positioned over the container by hydraulic shifting and steering operations.

Dual tandem positive displacement vane-type hydraulic pumps operate the hoist shifting and steering. The cylinders are double acting with chrome-plated piston rods and self-adjusting piston rod packing glands. Valves are also double acting self-centring with built-in adjustable pressure relief. Special flow control valves provide smooth lowering action and automatically regulate the lowering speed.

Seamless steel tubing with forged fittings is used for the fluid lines and synthetic rubber oil-resistant hose for flexible unit connections.

Wheel loading for the series 500 van carrier is 58 per cent on the front wheels and 53 per cent on the rear. Aisle requirements are 3 ft for each wheel track. Wheel base is 16 ft 9 in and the overall height of the carrier to the top of the cab is 18 ft 10 in.

PASSENGER CONVEYORS

Increased use follows improved designs in many countries

SPEEDWALKS, moving pavements and travolators are some of the names used on both sides of the Atlantic to designate the specially designed conveyor belts used for the mass movement of people.

Conveyor belts, even rubber coated ones, are not new and their history can be traced back to the closing years of the last century without difficulty. But these were concerned with things—coal, earth, ore, boxes, animals, etc.—and not with human beings whose mass movement on a commercial scale by conveyor belt belongs to this half of the twentieth century.

In the United States there are at least two dozen passenger-carrying conveyor belts; some long, some short, some moving upwards and some moving downwards. That is not a large number, but the point is that they are in service and are gaining wide acceptance. Nothing breeds success like success and it would appear that at the present time its economics allied to opportunity rather than engineering expertise which are the limiting factors.

Fig. 1. General view of test plant with unloading over the terminal pulley

In Europe, progress with the development of passenger-carrying conveyor belts, if slower, has been steady. In London, at the famous Bank station—linking Waterloo Station with the City—a twin-track 'travolator' is being constructed to carry 40,000 people every day at the rate of 800 a minute at peak hours through a 300 foot tunnel.

Germany is well aware of the need and effectiveness of this form of mass transportation and new city plans incorporating passenger conveyors were published several years ago. In Sweden the Sandviken Steelworks installed a passenger conveyor at its Works towards the end of 1958, as test plant and have since received orders for five ride-walk installations in various parts of the world.

American experience with passenger-carrying conveyor belts has been based on the use of specially designed and strengthened rubber belts. Reinforcing materials have made marked headway in recent years and include rayon, nylon and glass fibre as well as cotton and steel cables. Yet it must be stressed that all passenger conveyors are still in the experimental stage in as much as there are very few definite standardizations.

American Belts

It is possible to say, however, that American manufacturers appear to have decided on 24-in wide belts for single line traffic and that one leading company at least is adopting a band speed of 132 ft/min. This is based on a 24-in wide rubber belt and assumes an average weight per person of 150 lb (10 stone 10 lb) with a passenger spacing of 2.2 ft/lane. It would appear also that a 15 deg inclination is considered to be the maximum, and 12 deg maximum slope for passenger-carrying conveyors. Time and experience will be the final arbiters as to whether these figures will become standard practice.

European experience as reflected by the work carried out in Sweden by the Sandvik Steel Company, is basically different to that being undertaken in the United States. This is largely because the Sandvik Steel Company pioneered the manufacture of rubber-coated steel band conveyors which have been operating successfully in coal and iron ore mines for some years. It was only natural, therefore, that the rubber-coated steel band should present itself as an ideal conveyance for the mass movement of people.

Work on this project led the company to design and equip its works with a complete moving sidewalk installation. This was essential for the investigation, under actual working conditions, of belt thicknesses, appropriate coverings, idler spacings and a hundred-and-one other important details. In general terms, the results have been eminently satisfactory with the rubber-coated steel-band

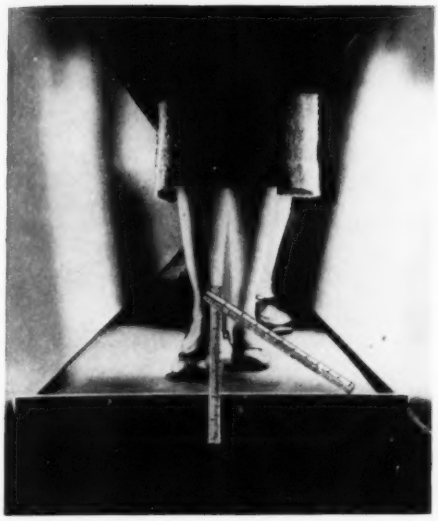


Fig. 2. A loading test where edge idlers are used. Note the small amount of troughing. During trial runs none of the passengers, not even those wearing high-heeled shoes, noticed it

conveyor showing itself to possess advantages, both technical and economic, over other types of existing conveyors used for carrying passengers.

For long conveyors the stiffness of the band, both longitudinal and transversal, means that a much smaller number of supporting idlers are required to give the same amount of support compared with other types of belting used for carrying passengers. This important economic advantage results in practice from the fact that the idlers can be spaced at 24-in to 36-in intervals, compared with idler spacing on conventional belts of 4 in to 5 in. The traffic load determines the idler spacing belt with their positioning being determined by the load carried.

This great economic advantage is allied to comfort because the longitudinal stiffness prevents any noticeable sag between the idlers. The transversal stiffness especially on a 24-in band can also be utilized by arranging the supporting idlers in such a way that they are placed only under the edges of the band so that a person standing in the middle of the conveyor is unaware of the supporting idlers.

For short conveyors, the band is usually run over a solid fixed support, such as wood. In this case the steel-band conveyor can be coated with rubber on the load side only, so that a smooth steel undersurface can slide easily over the fixed support. This type of steel band installation is very economical and has the added attraction of running extremely quiet.

The inherently high-tensile strength of the steel band is, of course, an obvious advantage in any kind of application where consistently high-loading factors are involved.

Another point of importance is that the Sandvik Steel band conveyors can be reversible, that it to say, they can be made to run in either direction even on a long conveyor band. Indeed, an installation in which two terminal pulleys are employed the return strand can be utilized also for carrying passengers in the opposite direction, excellent tracking being maintained by the terminal drums and the idlers.

With regard to the rubber-coated steel-band conveyor's resistance to wear and tear, it is, perhaps, sufficient to refer to the Company's installation of other rubber-covered steel bands for handling bulk materials.

Where passengers are concerned, safety is of paramount importance and the steel band's high resistance to fire must be stressed, as also the fact that the accident rate for passenger carrying conveyor belts is much lower than is the case with moving stairways.

With this form of transportation in an embryonic stage, it is not even clear that single-lane traffic can be handled adequately by 24-in wide bands. Nor, whether human traffic can best be accommodated by two, one-lane conveyors or, by one two-lane conveyor. Indeed, the simple but universal fact that baby carriages cannot be transported on a 24-in wide belt may well be the prime consideration in dictating that belts for even single lane traffic be at least 32 in wide.

Possible Markets

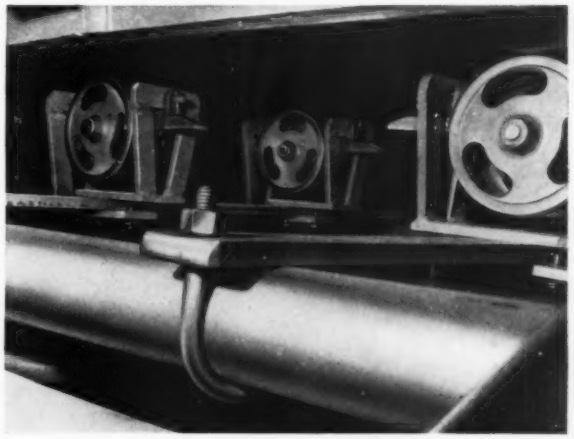
The potential market for passenger-carrying conveyors envisaged at present, includes rail, bus and air terminals; shopping centres; parking stations; sport arenas; race tracks; street crossings—both overhead and underground; through passageways in public and private buildings; traffic lanes in large factories; and finally in connection with large exhibitions.

Some knotty problems are thrown up by this formidable list of possible installations. For example, the question of taking baggage off a luggage conveyor running parallel with a passenger conveyor without disturbance is as yet unsolved. Moreover, the Sandvik Steel Company as belt suppliers only, must work hand-in-hand with those concerned with constructing the conveyor framework to decide on the optimum solution for the best terminal stations. This is particularly true with regard to the matter of the tension terminal requiring, as it does, a tension frame and counterweight for maintaining the same degree of flexibility in the steel band at all times.

There are, too, problems concerning the hand rails—moving or stationary—their design and also the unloading points which must be determined in conjunction with the conveyor-structure specialist. In any event, in a particular installation the matter of idler designs and idler spacings and clearance between the belt edges and the conveyor structure must all be investigated with an eye to providing the best band performance possible.

The foregoing problems are very much in the minds of those entering the field of human transportation by passenger-carrying conveyors and not least by those at Sandvik, Sweden, who are already in a position to supply rubber-coated steel-band conveyors 24 in and 32 in wide, and who will make available bands having a width of 40 in during the latter half of this year.

Fig. 3. Principal design of supporting belt edge idlers



INDUCTION COUPLINGS

New form of A.C. motor control gives precision speed and torque regulation over a wide range

WHAT is claimed as a new approach to the problem of A.C. motor control has been introduced by Pye Electric, Ltd. (Lowestoft Division). Known as TASC, which stands for Torque and Speed Control, it combines the advantages of precision, speed and torque regulation over a wide range with cheapness and durability.

Advantages claimed for the Pye TASC unit include continuous rating, the full torque value being variable over the full speed range; it may be stalled down without overheating; no maintenance is required; there is no physical contact between the members except on the shaft bearings; all units are very robust; control system is simple and regulation is fast and accurate; there are no slip-rings or brushes.

The unit consists of two members rotating independently and supported by a stationary fixed structure. A small air-gap separates the members. The input member consists of an input shaft carrying a poled rotor, the rotor being surrounded by a torque tube which, mounted on the output shaft, forms the output member. The fixed structure consists of the casing ring which surrounds the torque tube at one end and at the other the exciter coil which is fixed to eliminate the need for slip rings.

The input member is driven at a constant speed from a source of rotary power. When the exciter coil is energized from a D.C. supply a steady magnetic field which rotates with the poles of the rotor, is set up. This induces electrical currents and thus a magnetic field in the torque tube. The two fields interact to produce a torque in the torque tube which tends to drive it in the same direction as the poled rotor. The magnitude of this induced torque is directly

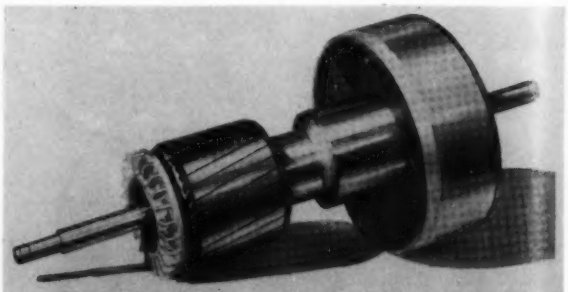


Fig. 1. Interior of the TASC unit

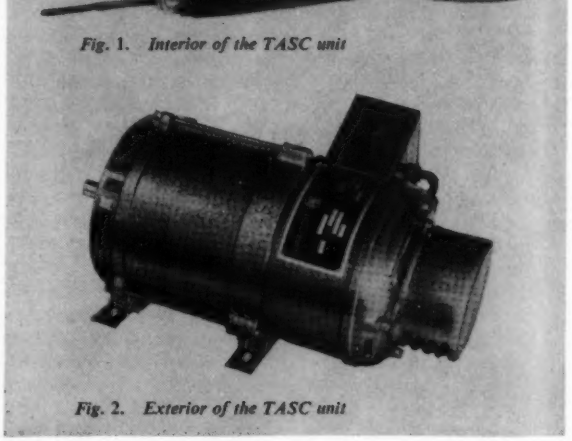


Fig. 2. Exterior of the TASC unit

Fig. 3. Master controller with cover removed

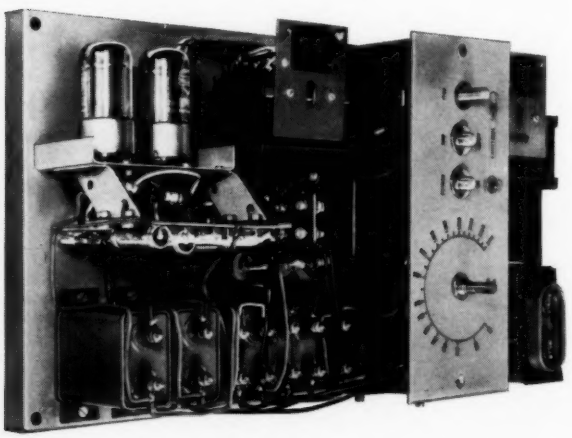


Fig. 4. Master controller exterior

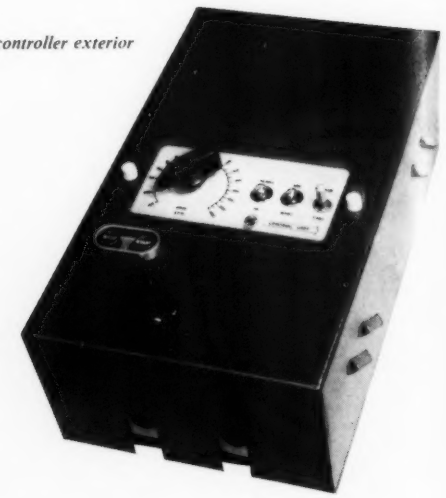
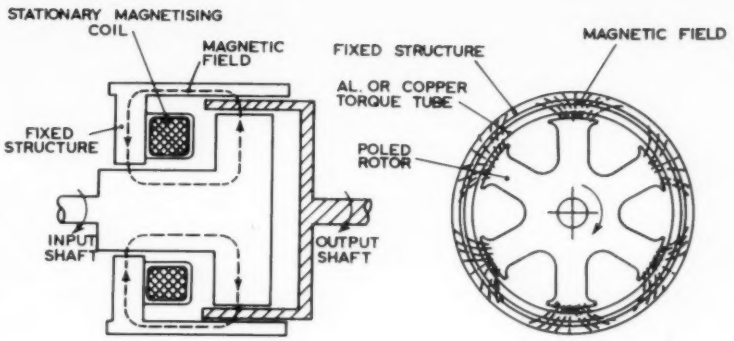


Fig. 5 (right). Basic construction of the coupling



proportional to the value of the exciter coil current and is, therefore, easily controlled.

As the energy is transmitted by a magnetic field there is no mechanical coupling between the poled rotor and the torque tube. The torque is almost independent of speed, making the coupling a variable torque device a feature that can be used to give controlled torque or controlled speed.

Torque Control

The exciter coil current may be varied from a D.C. source by means of a rheostat to provide the required control. An alternative is by the use of a variable transformer fed from an A.C. power supply with the transformer output rectified to feed the coupling coil. In both cases it is possible to calibrate the variable device in torque units.

A controller with more general applications from the point of view of remote control by low-sensing devices makes use of a thyratron current regulator which allows the controlling actuator to be of a low-power type.

Speed Control

A closed loop system is used to control the exciter coil current and thus the speed. The coupling exciter coil is fed by a current regulator the output of which is controlled by a D.C. bias which is obtained from a different unit. Into the difference unit goes a voltage proportional to the required speed which is set on a dial by the machine operator, and a voltage proportional to the speed at which the coupling output shaft is actually turning, obtained from a tacho-generator. The difference between these two voltages represents the speed difference between the operator's dial setting and the output shaft speed. This difference of voltage acts upon the current regulator to adjust the exciter coil current to correct for the speed difference by adjusting the torque available on the output shaft.

Applications of the TASC unit would seem to be considerable. It is planned to be available soon for machine tools, cranes, winches, coil winding machines, laundry machinery and, later, in such applications as fans, printing machines, feeders, mixers and welding machines.

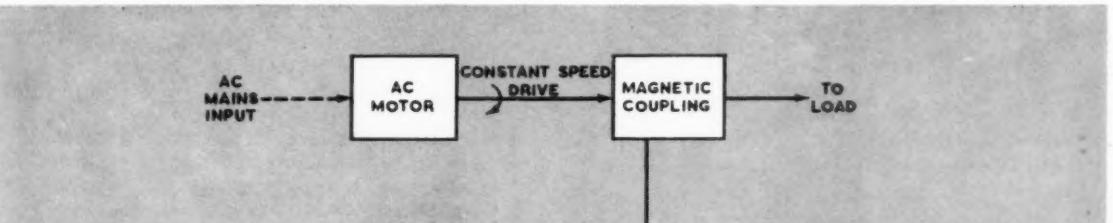


Fig. 6. Coupling torque control, basic block

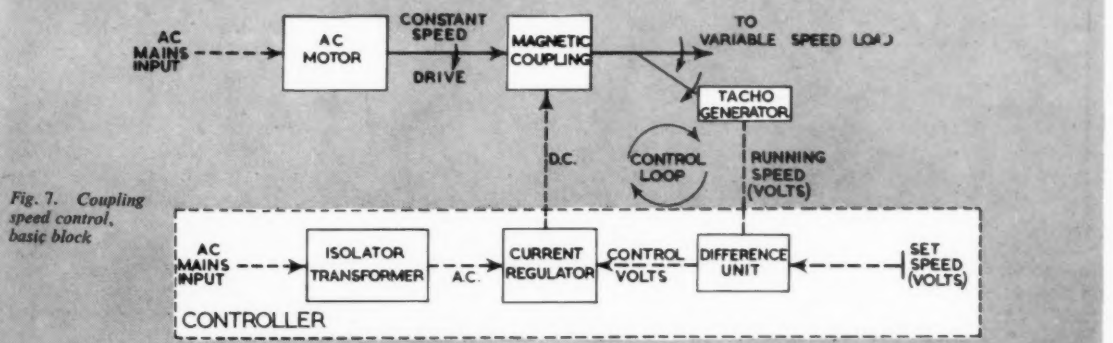


Fig. 7. Coupling speed control, basic block

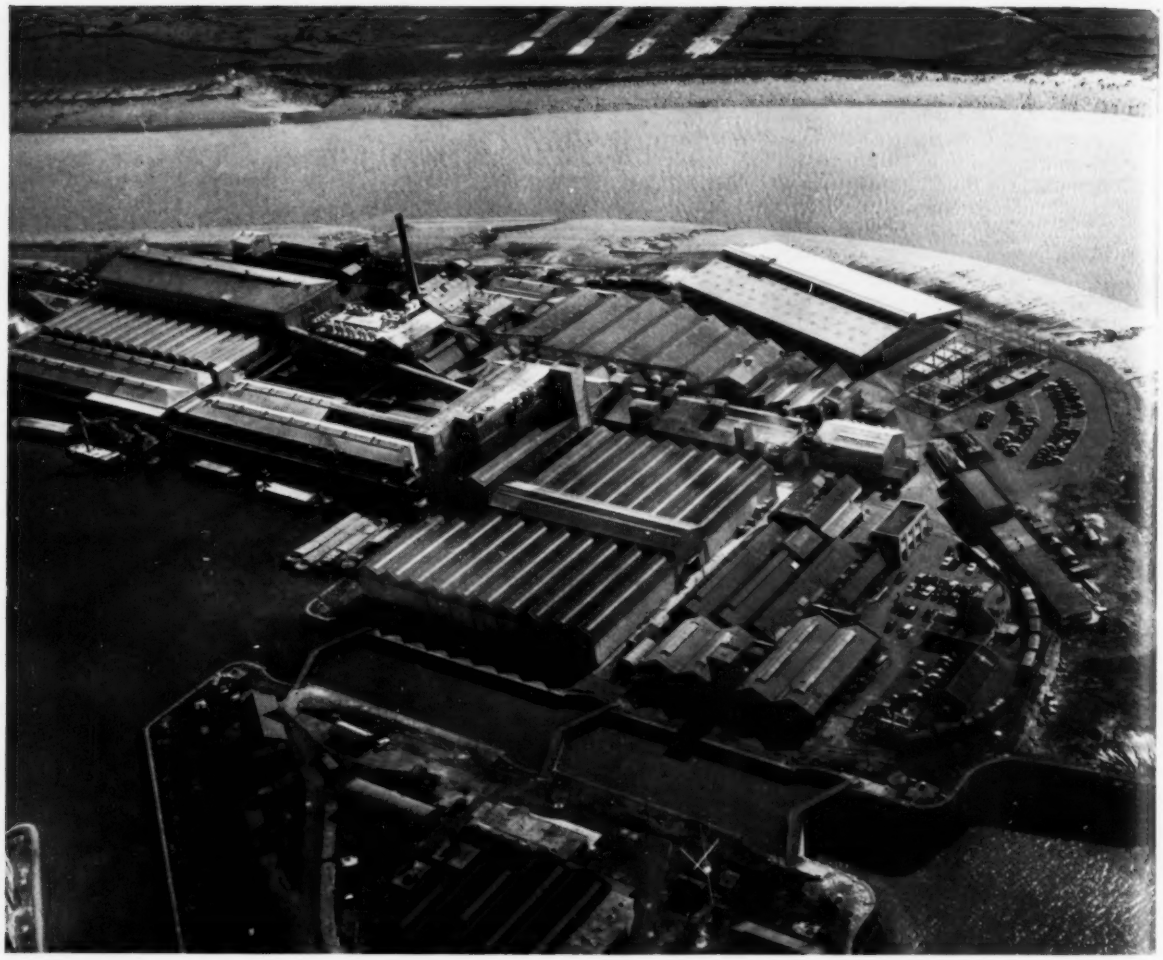


Fig. 1. Aerial view of Avonmouth Works. The recently built finished products warehouse can be seen at the top right hand corner. Photo by British Oil and Cake Mills, Ltd.

HANDLING PRODUCTS IN BAGS

by H. G. Vallings, A.M.I.Mech.E.

In many factories where the manufactured goods are despatched in bulk or in large consignments, equipment can be installed to handle the finished product at a tempo to match that of production which is frequently constant throughout the year.

At their Avonmouth Works, the British Oil & Cake Mills, Ltd. (B.O.C.M.), are faced with a rather different set of circumstances which pose interesting problems in handling the finished products. The products concerned are animal feeding stuffs packed in ½-, 1- and 1¼-cwt bags. To appreciate these problems, some knowledge of the distribution methods practised in this industry is necessary.

In the past farmers' merchants held stock of the various feeding stuffs so that deliveries from the factory could be in bulk or in reasonably large consignments and could be planned in advance. In recent years, however, owing to the great increase in the amount of feeding stuffs consumed, and in their variety (B.O.C.M. now manufacture 200 lines, taking into account both varieties and bag sizes), the holding of stocks has become impracticable and the merchants now rely on B.O.C.M. to maintain stock and provide an 'off-the-shelf' service.

While some of these products are despatched by rail to the more distant merchants, more than 70 per cent is

collected by customers' lorries which arrive at virtually any time of the day or night. On arrival the driver hands in his order, indicating the sequence of loading when several varieties are involved. B.O.C.M. rarely receive prior notification of these orders, and as their storage capacity is limited their production processes and, in consequence their handling systems, must be very flexible and efficient.

The handling problems are kept under continual review by the management, who have evolved, over the years, several interesting solutions.

Avonmouth Works

The works, which is reputed to be the largest of its kind in the world, is situated on a site of about 20 acres at Avonmouth docks. It consists of three separate mills whose output, until the completion of No. 3 Finished Products Warehouse (F.P.W.) in November, 1959, was carried on belt conveyors to either of the two other F.P.W.s. Now, in addition to the above arrangement, the products from two of the mills can be routed to the new F.P.W.

Up to about 20,000 tons of feeding stuffs are handled per week and for the most part two handling operations are involved—stacking the bags on the floors, and loading to the waiting vehicles—and the methods used in each warehouse are different. For loading the lorries handling systems are arranged so as to deliver the bags to a point from which the driver can conveniently load his own vehicle.

No. 1. F.P.W.

This is the oldest of the three warehouses and consists of an 8-storey building with a total storage capacity of 3,000 tons. Belt conveyors from the three mills transport the products to the top floor where, at a distribution point for each mill, the bags are fed into a series of vertical spiral chutes arranged along the centre of the building. The bags are diverted off the chutes at whichever floor they are required, loaded on to a hand truck, wheeled to the appropriate storage area and stacked on the floor by hand.

A further 34 vertical spiral chutes are disposed around the periphery of the building down which the bags can be fed to a customer's lorry. A device is fitted at the lower end of these chutes which stops the first bag but allows the next bag to take its place when the first has been removed by the driver. These chutes plus an additional three within the

Fig. 2. Automatic bagging machines fill and seal 56-lb bags at a rate of 8 ton/hr

Fig. 3. Idler drums mounted on the first floor are used to turn the ring belt through 90 deg

Fig. 4. Pulling a bag off the moving ring belt into a spiral chute

Fig. 5. Loading bags from a belt conveyor to stillages

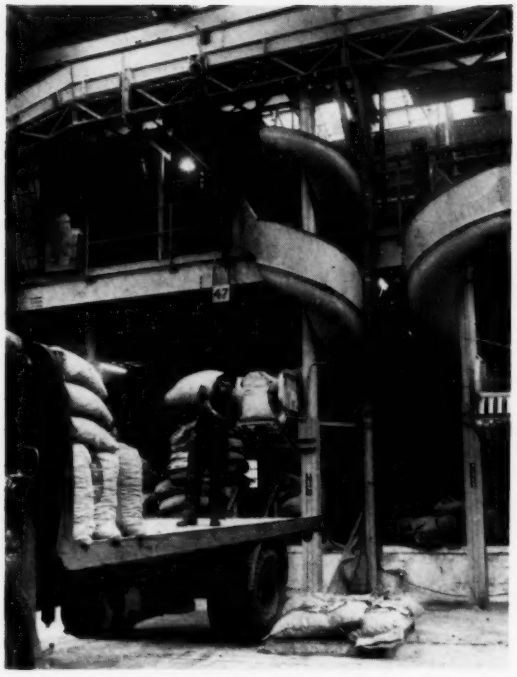
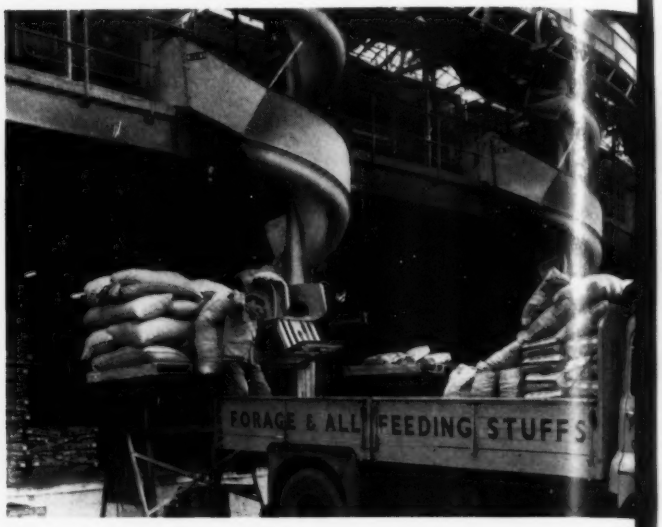


Fig. 6. A driver loading his vehicle from a spiral chute

Fig. 7. Driver loading from pallet placed by a fork truck on a turntable, which he can adjust in height by means of hydraulic rams



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building can be used for loading railway wagons. A diesel-engined tractor is used for shunting.

An entirely separate handling system, which eliminates double-handling, has also been installed. It consists of a belt conveyor 'ring' around the four sides of the second floor. At each corner the belt is taken to the floor below and turned in two stages by idler drums set at 45 deg as shown in Fig. 3, and a curved gravity chute is arranged to take the bags off the belt at the second floor and return them to the belt after the latter has returned to this floor.

This ring conveyor can be stocked with about 8 tons of bags direct from the top floor conveyors via a spiral chute. Loading vehicles from the ring conveyor is simply a matter of pulling the bags off the belt at any of the 34 spirals, Fig. 4.

No. 2 F.P.W.

More highly-mechanized methods of handling are employed in this 2-storey building, which has a total storage capacity of 1,500 tons. The products are carried by belt conveyors to the upper floor. Here the bags can either be loaded on to timber stillages in 15-cwt stacks and distributed with pedestrian-operated electric stillage trucks, Fig. 5, or conveyed by spiral chutes to the lower floor. The chute delivers the bags to a table from which they can be stacked in 1-ton loads on wooden pallets, four of which are placed within easy reach. These pallets rest on turntables to facilitate the stacking operation. The loaded pallets are distributed over the lower floor and stacked four high with fork trucks.

When loading vehicles from the upper floor the loaded stillages are moved by the electric trucks to the head of a spiral chute and the bags fed down to the vehicle below, Fig. 6.

When loading from the lower floor a fork truck places a loaded pallet on a turntable mounted on a platform which can be adjusted in height by means of hydraulic rams, Fig. 7. Push-button controls are provided so that the driver, in addition to revolving the turntable to reduce stretching, can make adjustments to enable him to take off the bags at a comfortable height throughout the operation.

An automatic loader, developed by B.O.C.M., is also installed in this warehouse. This was developed to deal with one product, Red Label milk nuts, which constitutes nearly one-third of the total sales and has a known peak demand, without the necessity of double handling. It consists of a feeder belt installed on the outside of the building at about eight feet above upper floor level, which can be started or stopped automatically according to demand (see Front Cover). Seven vertical spiral chutes are arranged so that bags can be diverted off this belt to the waiting vehicles. The belt is controlled by a scanning device which checks the room available in each vertical chute in turn continuously. If there is room for 8 bags in any particular chute, this number is delivered by the feeder belt and the scanner proceeds to the next chute. If there is no room for 8 bags the scanner proceeds to the next chute in sequence. The delivery of bags to the appropriate chute is performed by thrustor-actuated ploughs controlled by the scanning device. Each individual chute is controlled by a preset counter which indicates the number of bags required for any particular vehicle. If, for example, a lorry requires 27 bags, these will be supplied in 3 groups of 8 followed by 3 individual bags. When these 27 bags have been supplied, the spiral chute is left empty indicating to the driver that his order has been completed and allowing the spiral to be used if required for the delivery of other products stored on the first floor.

No. 3 F.P.W.

Whereas in Nos. 1 and 2 F.P.W. the rails run alongside the buildings close to the loading chutes making the simultaneous loading of lorries and wagons impracticable from one set of chutes, in No. 3 F.P.W. simultaneous loading is possible by virtue of a revised layout and a more flexible handling system.

This warehouse, which was built on reclaimed land on the banks of the Avon, has two floors and a total storage capacity of 2,000 tons.

The products from two of the three mills can be routed by separate belt conveyors to a point above the upper floor

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Fig. 8. A counter records the number of bags as they leave the spacer belt

Fig. 9. At a button-station a man can route bags to any of three spiral chutes

Fig. 10. Forming and moving palletized loads. Note pallet being placed on turntable to facilitate stacking

where the bags are fed on to a spacer belt inclined upwards at an angle of about 20 deg, Fig. 8. On reaching the end of this belt the bags slide down a chute to the feeder belt running at 300 ft/min. The speed of the spacer belt can be varied from 20 to 250 ft/min, so as to introduce the spacing required on the feeder belt to enable each bag to be diverted down the appropriate chute according to its contents. Thrustor-operated ploughs are again used for this purpose and are controlled at a button-station, Fig. 9.

Bags supplied down the chutes to the upper floor are stacked on stillages in $\frac{1}{2}$-ton loads, and because this floor has a hard, smooth surface these loads are distributed with hand stillage trucks.

Bags routed to the ground floor by the chutes are loaded on to pallets in 1-ton stacks and handled by fork trucks in the manner already described, Fig. 10.

On one side of the building there is covered access for railway wagons which are loaded from vertical chutes. On the other side covered access is provided for both means of transport: lorries close to the ground-floor store, and for wagons, the rails are laid some 40 ft further out. Lorries can be loaded by chute from the upper floor, or by means of portable belt conveyors from the ground floor, one man

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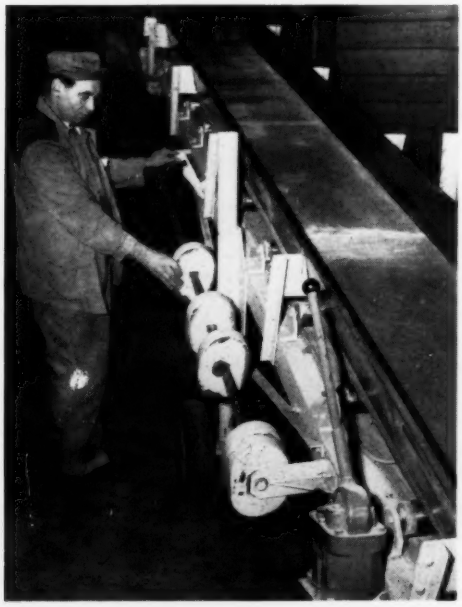
Fig. 11. Portable belt conveyor loading lorry

Fig. 12. Portable belt conveyor loading railway wagon. Note ballast weights in rear position

Fig. 13. Ballast weights being slid forward to give good balance for moving on its wheels



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feeding bags from a pallet placed on a turntable by a fork truck, and this latter system can also be used for loading wagons—the only difference being that the fork truck travels further, Figs. 11 and 12. These portable belt conveyors are electrically driven and their delivery height can be adjusted by means of hydraulic rams operated by a hand pump. To ensure adequate working stability a set of ballast weights is mounted on each side of the conveyor, and these weights can be slid forward on guide bars, Fig. 13, to give a good balance for moving the conveyor on its wheels to a new working position.

12

MATERIALS HANDLING EQUIPMENT AT THE 1959 BUILDING EXHIBITION

Reviewed by T. W. Highgate

It is to be expected that, before long, Britain will become the world's leading exporter of building and civil engineering equipment, particularly materials handling and earth-moving equipment. This expectation is based upon a study of mechanization trends in the building and civil engineering industries, and of mechanization trends in the agricultural industry—together with the fact that Britain is already the world's leading exporter of tractors and farm machines.

Basically, three important trends are favouring the further acceleration of economic mechanization in the building and civil engineering industries, both in Britain and in many countries overseas. These are as follows:

(*a*) Economic pressure by customers, resulting in increased emphasis upon faster construction methods.

(*b*) Increasing competition between rival contracting firms.

(*c*) Increasing total production of tractors, tractor assemblies and sub-assemblies, engines and hydraulic equipments, resulting in increasing competition between manufacturers and, with it, the encouragement of new and ingenious ways and means of economically employing standard low-price items such as these in all kinds of engine-driven and hydraulically actuated and controlled handling devices.

Recently, at the 1959 Building Exhibition which was held in London, at Olympia, mechanical handling engineers and others were given an opportunity of assessing mechanization developments in the building and civil engineering industries and of comparing these with parallel developments in the agricultural and other industries.

One interesting fact which emerged from a study of equipment at the Building Exhibition was that, to-day, more than ever before, the tendency is for tractor and tractor equipment manufacturers to think in terms of tractor engineering in general when developing new and improved equipment, and that this implies getting down to basic handling techniques, with the result that many new developments have a way of turning out to be equally suitable for building and civil engineering applications, for mining, quarrying,

Fig. 1. International Harvester 3½ ton to 5 ton load capacity model B-41-1 mobile crane which is built on to a special version of the B-450 tractor of 55 h.p. Features include road speed of 14·7 m.p.h., differential lock to overcome wheel spin, hydraulic steering and articulation between crane and tractor units. The maximum height under the crane hook is 18 ft. The machine is British in construction and is derived from an Australian design

road making, agriculture, drainage, and a hundred-and-one other applications in commerce and industry.

Of course, in every industry, a number of special-purpose equipments are also required, such as concrete mixers in building work, combine harvesters in agriculture, and so on. However, by and large, the industrial tractor market is one which embraces almost every kind of contract work and, because of this, manufacturing firms including those interested in tractor-mounted equipment, are more able to spread development and manufacturing charges over a wider range of applications. For this reason, the cost per horsepower made available in the field is—or should be—tending to drop quite sharply.

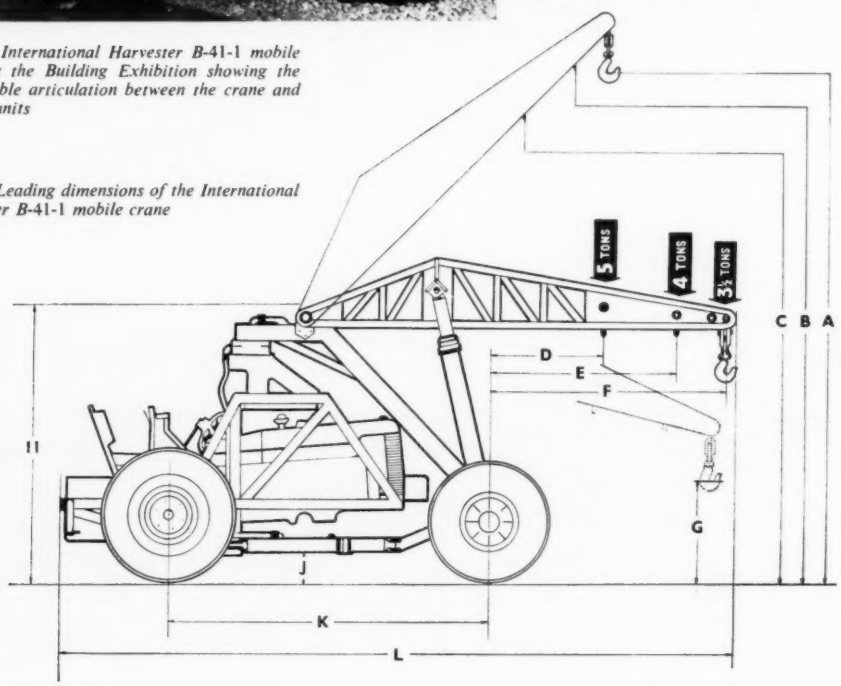
Much of the equipment shown certainly incorporated standard mass-produced items such as power units. And, leading engine manufacturers such as Perkins and Ruston & Hornsby, and Fords, took very great pains to emphasize the industrial applications of their well-known engines. Perkins engines are now manufactured by a component firm of the Massey-Ferguson organization. Perkins were not represented at the Building Exhibition, but large numbers of Perkins engines were used on machines shown at the exhibition. And, it is of interest to note that at about the same time as the exhibition, an announcement by Perkins Engines listed the large numbers of tractor manufacturers employing their engines throughout the world.

Fig. 4. The Arley forward-mounted tractor-crane attachment, exhibited by Witlor, Ltd. This has hydraulic hoisting and is quickly attached to a tractor or detached again. The second boom in the background is that of a second machine in the rear of the stand

Fig. 2. International Harvester B-41-1 mobile crane at the Building Exhibition showing the remarkable articulation between the crane and tractor units

Ruston & Hornsby did exhibit their engines at the show and this firm specially emphasized the fact that they were particularly suitable for powering contractors plant such as concrete mixers, dumpers, bulldozers, pumps, excavators, etc., as well as portable and stationary generating sets. Fords, too, emphasized the suitability of their engines for powering contractors' plant and equipment, and pointed out that Ford engines are used by many makers of road surfacers, road rollers, spreaders, dumpers, graders, cranes,

Fig. 3. Leading dimensions of the International Harvester B-41-1 mobile crane



	ft.	ins.
A	18	0
B	16	10
C	15	2
D	4	5
E	7	0
F	8	9
G	3	6
H	9	7½
J		7½
K	10	8
L	23	5

etc. In addition, Fordson tractors and tractor assemblies were exhibited.

Apart from the use of standard power units, much of the equipment shown at the exhibition, particularly the newer developments, were noteworthy for their simplicity and ruggedness. One had the feeling that during the last year or two, British manufacturers have been streamlining their products, improving their engineering design, making them altogether more competitive, lighter in weight, more versatile, and attempting to produce models which are likely to justify long production runs by combining really up-to-date functional design, based upon proven market requirements, with modern economical construction methods.

Worth Special Mention

Many of the exhibits are worth special mention. For example: a Canadian crawler tractor with a ground pressure of less than 1 lb per sq. ft., a Rhodesian tractor-trailer development which enables a wheeled tractor to handle a 10-ton capacity articulated dumper trailer, now being made in Britain, an articulated tractor-crane outfit, a self-discharging concrete skip, a rear-mounted Ransomes fork lift on a Fordson Dexta tractor, a freestanding man-carrying lift hoist able to handle 2-ton loads or 20 men at 300 ft. per min, and power-operated roof cradles.

In the report which follows these and other exhibits of outstanding interest are briefly reviewed. It is believed that one does not have to be unduly optimistic by nature in order to expect such equipment to sell in large quantities on the export market. In this connection it may be relevant to quote manufacturers exhibiting at the Building Exhibition —and at the subsequent Smithfield Show of tractor and farm machinery—many of whom replied in substantially similar language to praise for current models, as follows: 'It's got to be good to sell to-day'. The point is that the slogan: 'It has got to be good'! is being adopted by increasing numbers of contractors' equipment manufacturers.

New Ideas in Mobile Crane Design

A number of manufacturing firms are keenly interested in the further development of tractor-based mobile cranes. A case in point is the International Harvester Co., which exhibited a design pioneered in Australia and now made in England, the B-41-1 mobile crane. This consists of a self-contained front-wheeled hydraulic crane unit, powered, driven and power-steered from an International Harvester 55-h.p. model B-450 wheeled tractor, minus its front steering wheels, the two units being joined through an articulated-type steering connection.

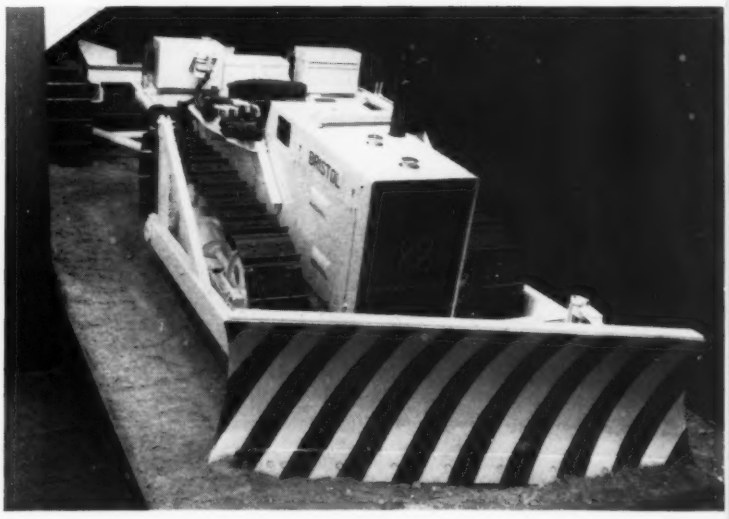
The new crane has a maximum load capacity of 5 tons. Maximum hook height is 18 ft, corresponding load capacity being 3½ tons. A differential lock by-passes the differential when operating on slippery ground. This, and the use of large-capacity tyres, provide good flotation and make for good off-road performance. The new crane is also sufficiently manœuvrable for efficient yard working.

A frame round the tractor unit supports the rear of the main jib frame and provides location for the front axle and steering cylinders, which are so mounted as to provide full articulation between the front crane axle and the rear tractor axle. The jib is supported at the rear by a cross-shaft and in front by two double-acting 6-in dia hydraulic cylinders, which raise and lower it. Steering is by means of two displacement-type cylinders, which allow for a 30-deg jib movement on either side, enabling loads to be placed with the machine at rest. The use of hydraulic jib control

Fig. 6. Bombadier Muskeg carrier with self-tipping body

Fig. 5. Bombadier Muskeg soft-land crawler tractor and tracked trailer, shown by The Rolba Co., Ltd. The tractor has a ground pressure of less than 1 lb/sq. ft.

Fig. 7. The new Bristol model D.44 crawler tractor with angledozer shown by H. A. Saunders, Ltd.



permits precise handling when stacking, loading and unloading.

The hydraulic reservoir has a capacity of 18 gal and is positioned beneath the armchair-type seat. A tandem-type gear pump is used, driven from the crankshaft power take-off and this provides hydraulic power supplies for steering and lifting purposes, respective requirements being at 9 gal/min, and 27 gal/min. Raise, hold and lower positions are provided, the control lever returning to the hold position when released from hold or lower positions. A visual aid and audible overload warning device can be incorporated in the main lift circuit to comply with the law when working on building sites.

The tractor transmission provides five forward speeds and one reverse speed, giving speeds of up to 14·7 m.p.h. The control system is simple, consisting of the usual tractor controls together with a single hydraulic jib control. The new mobile crane is already popular in Australia, where it is

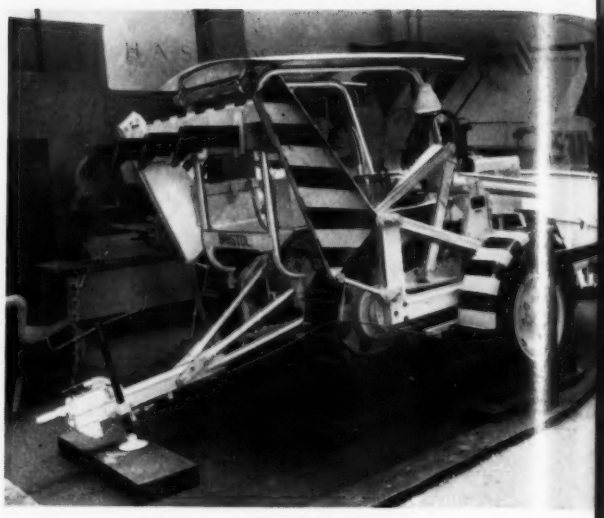


Fig. 8. Bristol crawler tractor with 'Skate' wheels fixed to side frames, converting it into a trailer

Fig. 10. International Harvester's 3 cu. yd. Drott skid shovel on 7-roller rigid frame version of the 124 h.p. BTD-20 crawler tractor. This machine was shown at the Building Exhibition and has a bucket which can carry out scraping, shovelling or clamshell duties, as well as two types of dumping

used for logging, loading, stacking and general duties on building and contracting sites.

Fig. 1 shows the new International Harvester B-41-1 mobile crane negotiating uneven ground, and Fig. 2 shows the same machine at the Building Exhibition, with the tractor unit articulated round from the crane unit, as would occur when turning in transit or when turning the boom to pick up or drop a load to one side of the machine. Fig. 3 gives the leading dimensions of the B-41-1 mobile crane, and the load ratings are as follows:—

Maximum capacity, tons.....5

3 hook positions	Max. hook height	Max. reach from front axle
3½ ton position	18 ft 10 in	8 ft 9 in
4 ton position	16 ft10 in	7 ft 0 in
5 ton position	15 ft 2 in	4 ft 5 in

Degree of slew, either side of centre line.....30 deg

Another interesting tractor-crane was exhibited by Witlor, Ltd., the Arley forward-mounted tractor-crane attachment, made by Arley Fabrications, Ltd. This is mounted on a pair of wheels and is coupled to the front of a Fordson Power Major tractor. This machine is shown in Fig. 4, and is for the lifting and placing of loads up to 15 cwt, the maximum lifting height being 24 ft. The whole outfit can be coupled or uncoupled from the tractor in 15 min. The crane unit is fitted with standard Fordson wheels with 8-ply tyres. Lifting and lowering is carried out hydraulically, through a hydraulic ram located in the crane tower, working through the hydraulic system of the tractor and controlled from the driver's seat. The actual mechanism is simple but robust, using a pivoted crane jib swinging about the top of the ram, with its inner end anchored to a cable. The crane unit is sturdily built, mounted on its own chassis, and secured to the rear end of the tractor by means of a boom and simple attachment.

Crawler Tractor Developments

Interesting crawler tractor developments were shown by a number of well-known firms. One firm The Rolba Co., Ltd., showed a Canadian crawler tractor, the *Muskeg*, built by Bombadier Snowmobile, Ltd., of Valcourt, Quebec. This has a ground pressure of less than 1 lb per sq. ft and is suitable for marsh land duties. The exhibitors told a

Fig. 9. Massey-Ferguson model 702 industrial tractor with model 702 hydraulic shovel, and model 710 rear-mounted hydraulic digger. Note facing-rearwards seat for control of the digger and hydraulic control panel

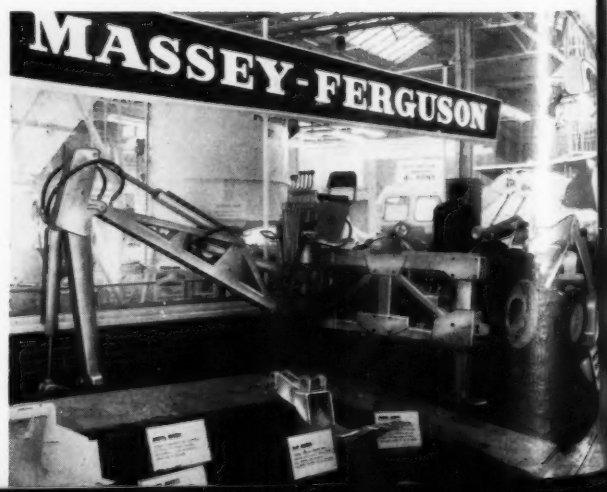


Fig. 11. Two of the new Weatherill hydraulic 4-wheel drive loaders shown at the exhibition, models L64 and L60, left and right respectively, with lifting capacities of 11,000 lb and 3,400 lb

Fig. 12. Shawnee-Poole tractor-trailer dumper system, exhibited by Steel Fabricators (Cardiff), Ltd., showing sharp turns rendered possible by the articulating joint employed. The load is carried forward of the rear axle of the tractor

Mechanical Handling reporter that they feel that there is a great future for this machine in Europe and to a certain extent in Britain. They have the agency for Europe and recently sold 30 machines to Rumania for use in the marshlands of the Danube delta, for reed cutting, etc. A number of *Muskeg* tractors are at work in other parts of Europe, for example, in Switzerland, where they are used for rescue work on mountains during hydro-electric contracts.

The Bombadier *Muskeg* tractor has exceptional climbing ability and can operate steep boulder-strewn hillsides, it can work on pebble-strewn areas, on snow, soft soil, and travel through water up to the level of the carrying platform. A fully amphibious version is also available. Rubber tracks are used and the power unit used at present is a Chrysler 6-cylinder 115-h.p. 3,400-r.p.m. petrol engine. However, the possibility of fitting a diesel engine is being studied.

The machine exhibited is shown in Fig. 5, and was fitted with a winch and hoist, and with an articulated crawler-tracked trailer. A wide rage of alternative equipment is also available, one example being shown in Fig. 6. These include the following: carriers with forward-mounted engines and loading platforms, carriers with additional facilities such as tipping bodies, logging arches, mounted exploration drills, tracked trailers with articulated connections, special lumber carriers consisting of short crawler units designed to support the ends of logs carried on the carrier platform, bulk materials containers, winches, etc. Among the more specialized equipments the following may be listed; a carrier

Fig. 13. Millars' portable batching and central mixing plant, incorporating Millars' 30 sec mix universal mixer, an installation suitable for production of dry, lean and high quality concretes and for batching of truck mixers. (Photograph by Stamford Construction, Ltd.)

with hydraulically operated piling arch for lumber work, which could possibly be re-designed as a crawler-mounted hydraulic general-purpose loader; and a four-track-drive freighter, consisting of a carrier and powered crawler-tracked trailer, both attached to a double-articulated load-carrying chassis, with hydraulic steering and power on all four tracks.

The Rolba Co., Ltd., has its headquarters in Switzerland, and has an office in London. On being asked about the sales potential in Britain, the reply given was this was believed to be quite considerable, for such applications as timber extraction, mountain and hillside work, work on moors and peat bogs, etc., as well as soft land duties and work in marshes and swamps. It was emphasized that in the firm's view there was no competing tractor, because of the low overall weight of the *Muskeg* and its very low ground pressure.

On a point of information it should be noted that a soft land tractor is already in production in Britain, the Albion-Cuthbertson, made in Scotland. This is a somewhat heavier machine and it is well known in certain overseas countries as well as in parts of Britain. Another crawler tractor of interest was at one time being developed by Atkinson's of Clitheroe, an Austrian tractor-carrier designed for timber-extraction and mountain duties and this too, has a rubber crawler track. Mention might also be made of the American Weasel tractor.

Bristol Crawler Tractor

A new Bristol crawler tractor was shown by H. A. Saunders, Ltd., and is illustrated in Fig. 7. This is the Bristol Series D.44, which is powered by a Perkins 3-cylinder diesel engine giving a maximum output of 32 b.h.p. at 2,000 r.p.m. The machine has three forward speeds, 1·5 m.p.h., 2·5 m.p.h., and 5 m.p.h., and a reverse speed of 2 m.p.h. It is available with angledozer, Duplex angledozer and loading bucket, and with Digloader dozing and excavating and loading equipments.

One interesting innovation is the availability of a built-in Skate equipment on this new tractor. This employs pneumatic wheels, which can be fitted to the sides of the tractor, quickly converting it into a road-towing trailer, as shown in Fig. 8. Attachment and detachment take 5 min only.

Massey Ferguson Tractor-Digger

The Massey-Ferguson organization exhibited their new model 702 industrial tractor fitted with a model 702 hydraulic shovel and a model 710 hydraulic digger. The complete assembly is known as the Massey-Ferguson tractor-digger-shovel rig, and a detailed description of this machine was given in *Mechanical Handling*, October 1959.

A new large-capacity crawler tractor loading shovel was exhibited by International Harvester, their 3-cu. yd. Drott skid shovel on a 7-roller rigid track frame version of the 124-h.p. BTD-20 crawler tractor. This was stated to be the largest British-built crawler shovel at present available, with either regular heavy-duty bucket or Drott 4-in-1 features. The new machine is able to carry out the following operations: bulldozing, scraping, shovelling, or clamshell loading. In addition there are two different dumping methods.

The new machine is shown in Fig. 10. It is known as the International Drott B-20K-3 and it is powered by a Rolls-Royce quick starting engine of 124 b.h.p. In addition to the well-known Drott features, the new machine has full-reverse 6-speed transmission. Tractor shovels need extra flexibility when travelling in reverse, since many jobs are of a shuttle type, while the loading cycle is made up of digging followed by a reversing and approach run. Cutting travel time in reverse allows more productive passes to be made in the hour. Each reverse speed on the new crawler loader is

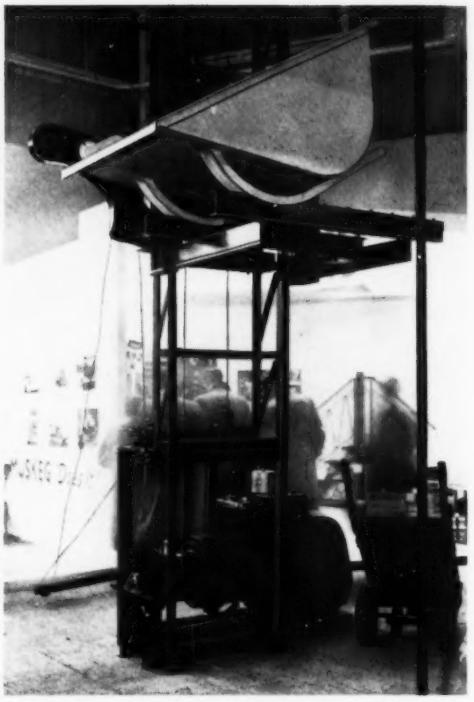


Fig. 14. Warry automatic concrete tipping skip, a self-contained device which may be used with any hoist and is independent of scaffolding

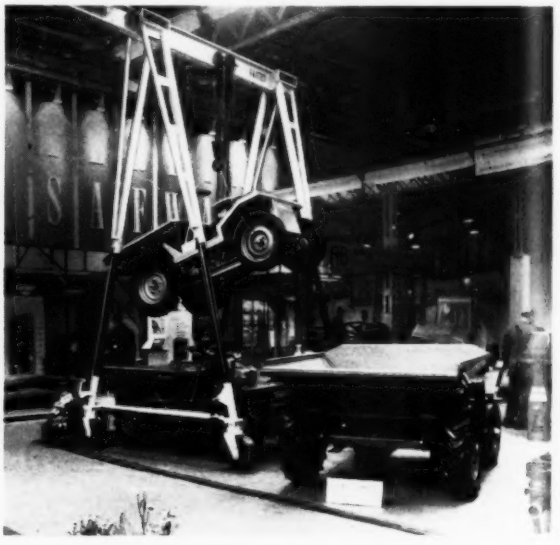


Fig. 15. Neal-Wright 3-ton load capacity mobile gantry, with a Thwaites dumper suspended from it

20 per cent faster than the same speed forward, and the equipment can reverse as fast as 8·4 m.p.h.

Weatherill Loading Shovels

Recently three new four-wheel-drive loading shovels were announced by F. E. Weatherill, Ltd., their models 60, 62 and 64. Two of these three machines were shown at the Building Exhibition, models 60 and 64, and are illustrated in Fig. 11.

Model 60 has a struck bucket capacity of 1 cu. yd., and

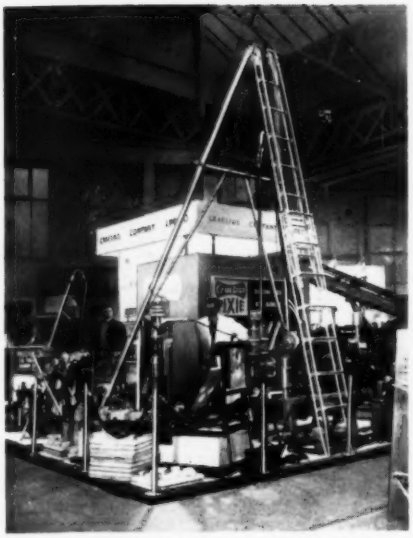


Fig. 16. Craelius tripod derrick of over 2 tons load capacity, used for support of a diamond drilling rig, but probably of general value for materials handling on site

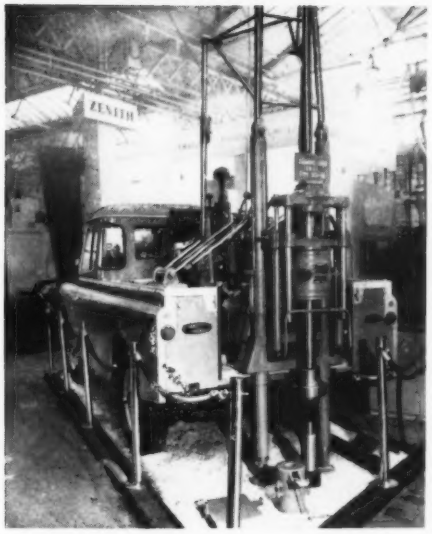


Fig. 17. Land-Rover-mounted Craelius diamond core drill

model 64 has a struck bucket capacity of $1\frac{5}{8}$ cu. yd. Corresponding lifting capacities are 3,400 lb and 5,000 lb. Extracts from the specifications are given below:

Item	Model 60	Model 64
Engine	Ford diesel	Rootes diesel 3-cylinder, 6-piston
Rated H.P. (S.A.E.)	62	108
R.P.M.	2,250	2,000
Torque converter ..	Brockhouse 3:1 stall torque ratio	Twin disc. 15 in single stage
Transmission	Brockhouse epicyclic hydraulically operated gearbox. Weatherill transfer box.	Weatherill power shift four speed forward and reverse with selector for 2- or 4-wheel drive.
Bucket:		
S.A.E. heaped capacity	$1\frac{1}{8}$ cu. yd.	2 cu. yd.
S.A.E. struck capacity	1 cu. yd.	$1\frac{5}{8}$ cu. yd.
Lifting capacity, safe working load	3,400 lb	5,000 lb
Width	7 ft $4\frac{1}{8}$ in	7 ft 6 in
Maximum dumping height	9 ft 6 in	9 ft 3 in
Maximum load over height	11 ft 6 in	11 ft 6 in
Angle of dump, maximum height ..	42 deg	40 deg
Angle of tip-back at recommended carrying height of 3 ft 6 in measured from ground to cutting edge.....	40 deg	40 deg
Raising time	8 sec	9 sec
Lowering time....	5 sec	6 sec
Maximum digging depth	10 in	10 in

Tractor-Trailer-Dumper System

An extremely interesting exhibit was that shown by Steel Fabricators (Cardiff), Ltd., their Shawnee-Poole tractor-

Fig. 18. Parker paver built round Fordson Major tractor with County strengthened axles

Fig. 19. County Fourdrive tractor and County model CD50 crawler tractor, both with angledozers

trailer-dumper system, which was designed and developed by H. G. Poole & Partners, Rhodesia (Pvt.), Ltd., and is now manufactured in Britain. This consists of a specially designed trailer dumper which works with a Fordson Power Major tractor through an unusual articulating coupling system. The trailer dumper is massively constructed and runs on two pneumatic wheels and it has a load capacity of 10 tons. It is hydraulically tipped and is attached to the tractor unit by a goose-neck extension which permits 110 deg of turn, thus reducing turning room and turning time. The goose-neck is connected to a Vee-attachment to the tractor, designed to transmit the weight of the dumper to a point forward of the tractor rear axle, as shown in Fig. 12.

In practice, experience with the new dumper system shows that it is very practicable and the manufacturers claim that one of their outfits can replace two trucks on many earth-moving and similar sites. Top running speed is 18 to 20 m.p.h. and quite steep and rough grades can be worked.

Narrow Builders Dumper

A narrow builders dumper was exhibited by Thwaites Engineering Co., Ltd., their *Sprite* dumper which has a load capacity of 15 cwt and is 11 in narrower than standard dumpers made by the same firm, being only 4 ft $1\frac{3}{8}$ in wide, and thus able to pass through more confined passages and openings on building and civil engineering sites. This machine is powered by a Petter 5/6-h.p. single-cylinder diesel engine and has a turning radius of less than 7 ft 9in.

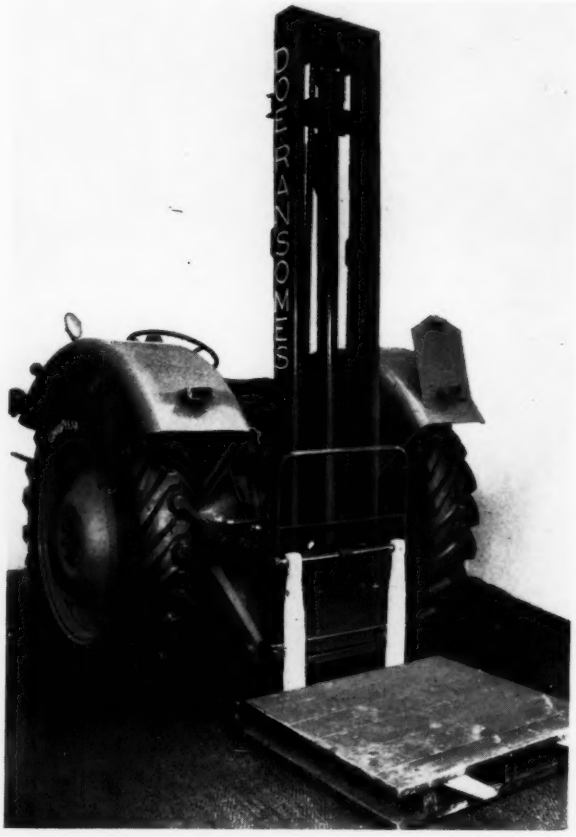


Fig. 20. Doe-Ransomes fork lift, consisting of a model NR15 Ransomes fork lift of 15 cwt load capacity, rear-mounted on a Fordson Dexta tractor, shown by Ernest Doe & Sons, Ltd.

Fig. 21. Blaw Knox—C.C.C. truck-mounted concrete mixer, the new Mixer-Master

Concrete Batching and Handling Plants

One of the most impressive exhibits at the show was the Acrow central batching plant with remote-controlled push-button system. All discharge gates from aggregate, sand and cement storage bins discharged on to a belt conveyor which was also remote-controlled, permitting the combined aggregate to be discharged to either end of the conveyor.

Another equally interesting exhibit was that shown by Millar's Machinery Co., Ltd., their Autocrete batching and central mixing plant, which was arranged to illustrate the application of complete automation to concrete production, and to production of lean-mixes and graded aggregates, as well as the batching of components suitable for the charging of ready-mix trucks. Fig. 13 shows a portable batching and central mixing plant made by this firm.

Automatic Concrete Tipping Skip

A new development in tipping skips was shown by Warry Engineering, Ltd., their Warry automatic concrete tipping skip, as illustrated in Fig. 14. This is self-contained and is designed to work with any builders hoist. It has a special shape and this enables it to sit squarely on its rails, both when fully loaded and when empty, without requiring catches or spring trips.

When it has reached its tipping height, a rubber-tyred wheel mounted on the skip enters a contoured guide channel. This causes the skip to roll forward and to clear the edge of the receiving hopper, and then it controls the rate of discharge of concrete from the skip. On completion of tipping, the hoist stops automatically and it is then ready for lowering, when the skip is guided back into the rest position. The skip is completely independent of the scaffolding, has a positive action, and is designed to ensure that there is no shock on the receiving hopper. Furthermore it is clean emptying.

Hoisting Gantries and Derricks

In the building and civil engineering industry hoisting gantries and derricks are not employed on anything like the scale which would be the case if more attention was paid to mechanization of odd handling jobs on site. Two pieces of equipment of this type seen at the Building Exhibition deserve wider use. These are shown in Figs. 15 and 16. They are, respectively, the Collosus 3-ton capacity gantry

Fig. 22. Whitlock hydraulic power shovel and Dinkum Digger mounted on Fordson Major tractor

shown by Neale Wright & Co., Ltd., and a tripod derrick shown by the Craelius Co., Ltd.

The Neal-Wright gantry is mounted on large-diameter castor wheels and has a block and tackle on a length of rolled steel joist. Use of such equipment can greatly simplify and expedite many of the awkward on-site handling jobs which are still all too often carried out manually. Sometimes at considerable risk to life and limb. At the Building Exhibition the Neal-Wright gantry was shown with a Thwaites dumper suspended from its block and tackle.

The tripod derrick on the Craelius stand was not actually an exhibit in itself, its function being to suspend a diamond core drill for exhibition purposes. However, in view of its light tubular construction and good loading capacity, something over 2 tons, and features such as the integral ladder, it is felt that a good sale for such equipment could materialize if builders, contractors and others were to seriously consider mechanization of handling jobs still carried out manually or by means of improvised derricks, etc.

Miscellaneous Mobile Equipment

Another interesting exhibit on the Craelius stand was that illustrated in Fig. 17, a Land-Rover-mounted diamond core drill for site surveys, mineral exploration, and well boring duties. During the past few years increasing use has been made of Land-Rovers for mounting contractors' plant and similar equipment. It does seem as if Land-Rover-mounted conveyors and elevators and other handling aids are due to make their appearance.

A second interesting piece of recently developed mobile equipment was that shown in Fig. 18. This was exhibited on the stand of County Commercial Cars, Ltd., and consisted of a Parker paver finisher built round a Fordson Power Major tractor fitted with County strengthened axles. Joint work of this kind can be expected to rapidly increase in the near future and to greatly expanded use of all kinds of simplified and tractor-based special-purpose processing and handling equipments. When one considers just what can be done with standard tractor units and assemblies, with hydraulic and mechanical power take-off points and similar easily and cheaply available equipment, it does seem remarkable that so few mechanical handling equipment firms appear to have studied the achievements of other constructors of tractor-based equipment—and imitated them.

On the County stand two of the County Commercial Car range of tractors were prominently displayed, as shown in Fig. 19. These machines are, left, the well-known County Fourdrive four-wheel-drive tractor, shown fitted with an angledozer and right, the County CD50 crawler tractor, shown fitted with an angledozer and a Boughton winch. Both tractors employ Fordson tractor engines.

Two other pieces of mobile equipment which were shown deserve special mention. These are illustrated in Figs. 20 and 21. They are, respectively, a Doe-Ransomes tractor-mounted fork lift, and a Blaw Knox truck-mounted Mixer-Master concrete mixer.

The tractor-mounted fork lift was exhibited by Ernest Doe & Sons, Ltd., and consisted of a Ransomes Sims & Jefferies model NR15 fork lift of 15 cwt capacity, rear-mounted on a Fordson Dexta tractor. The makers stated that a second model is also available, a model NR25 Ransomes fork lift rear-mounted on a Fordson Power Major tractor, the load capacity in this case being 25 cwt. In this connection it is of interest to note that the Massey-Ferguson Organization

Fig. 23. J. C. Bamford Loadall 65 with 70-ton load front axle and bulldozer blade

Fig. 24. J. C. Bamford Hydra-Digga 65

were distributing a leaflet describing a Massey-Ferguson tractor with a rear-mounted fork lift.

The machine shown in Fig. 21 was produced jointly by Blaw Knox, Ltd., and Crane Carrier Canada, Ltd., of Toronto. It was described as an engineered mobile mixer consisting of a C.C.C. mixer-carrier especially designed for the purpose, mounting a Blaw Knox Moto-Mixer. In view of previous remarks about joint production of mobile special-purpose equipment, the following brief extract from the specification may be of some interest. Single engine design, with 6-cu. yd. mixer driven from 185-h.p. diesel truck engine through C.C.C. flywheel power take-off. Design features include the following: weight less than 44,800 lb with 6-cu. yd. payload of concrete; wheelbase 135 in; welded structural frame throughout; control-tower cab layout; heavy-duty front axle to suit forward weight distribution and designed for easy steering, using hydraulic power steering; rubber-mounted rear bogie suspension; rear axles with miter-axle 'third' differential; C.C.C.-Clark Transverter—i.e. a torque converter, hydraulic multiple disc clutch and 5-speed synchronized gearbox system; C.C.C. flywheel power-take-off; new 6-cu. yd. *Adjusta-Wate* moto-mixer, incorporating the most recent advances.

Many well-known pieces of mobile handling equipment were exhibited at the show, typical examples being those shown in Figs. 22, 23, 24 and 25. These illustrations show, respectively, the Whitlock power shovel and Dinkum digger, mounted on a Fordson Power Major tractor; the J.C. Bamford Loadall 65 with bulldozer and heavy-duty 70-ton front axle; the J. C. Bamford Hydra-Digga 65; and a Potain 42-ft tower crane arranged ready for road haulage, shown by Witlor, Ltd.

Mobile Conveyors

A number of mobile conveyors were also exhibited. One of these was shown by David Roberts & Co. (Engineers), Ltd., their Robel articulated concrete-placing conveyor, designed to form a flexible chain from mixer to formwork.

Another mobile conveyor was shown on the stand of a German firm, Zenith Maschinenfabrik Gm.b.H., the Rheta mobile conveyor, illustrated in Fig. 26. This has an interesting tubular frame construction, is of the variable delivery height type, and is available with swivel wheels. A range of mobile conveyors is manufactured, the largest being 67 ft in overall length.

Fig. 25. Potain tower crane ready for road haulage, shown by Witlor, Ltd.

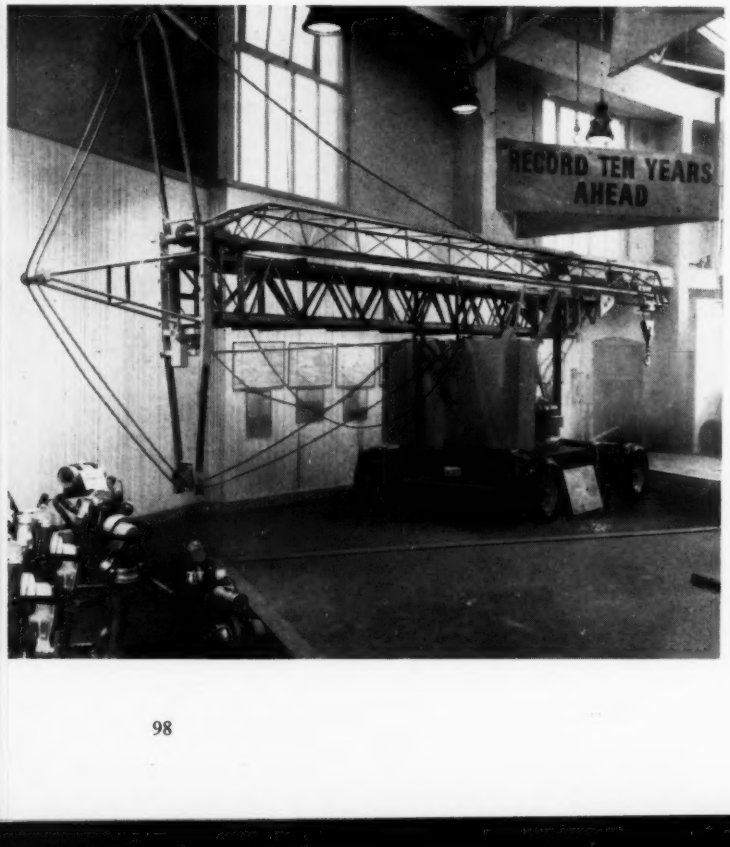


Fig. 26. Rheta mobile conveyor on the Zenith stand

A.C.E. Skymaster Hoist

A new Skymaster man-carrying hoist was shown by A.C.E. Machinery, Ltd. This was their Mark II machine, which is really a self-contained lift, the market for which might well be extended from building sites to buildings such as warehouses and factories requiring additional lift services for passengers and goods.

The new hoist is a free standing outfit and is supplied as a packaged unit, complete with its own prefabricated joist tower, freestanding to a height of 75 ft to top landing height, when free-standing on a ballast base. When bolted to a reinforced concrete foundation the hoist can work to an ultimate landing height of considerably more than 200 ft. The new hoist has a load capacity of 1 ton or 12 men, with an ascending speed of 100 ft/min. Two other new models are also available: the Mark IIa, with a similar load capacity to Mark II, but a higher speed, 230 ft/min, and the Mark III, which has a load capacity of 2 ton or 20 men, and an ascending speed of 300 ft/min. The new hoists should prove popular because of their good performance, their lightness and easy erection on site.

Power-operated Roof Cradles

Two firms exhibited power-operated roof cradles of considerable interest to mechanical handling engineers, Palmers Travelling Cradle & Scaffold Co., Ltd., and Mills Scaffold Co., Ltd.

The Palmer equipment is called the *Palmatic* system and is an electric travelling cradle, operated from either the cradle or from the roof. It is fitted with magnetic brakes and has many passenger lift-type safety features. Manual lowering gear is fitted, for use in case of emergency such as a power failure. The cradle has a load capacity of 7 cwt and full lateral and vertical manœuvrability along the full face of a building is obtainable.

The Mills system is equally interesting and is available in a number of versions with, broadly speaking, similar functions to those of the Palmatic system.

A survey of mobile conveyors and elevators, portable and transportable conveyors, and similar equipment — Part 19

'NON-FIXED' CONVEYORS AND ELEVATORS

By J. M. Beskine, B.Sc.(Eng.)

THE registered trade name, *The Loadaveyor*, designates the fully mobile electrically operated conveyors and loaders manufactured by J. Collis & Sons, Ltd., a firm well-known for its contributions to mechanical handling design, among them the classic Collis Truck. In addition, many of the other conveyors made by this firm are also available in mobile form, for example *The Rolaveyor* range of gravity roller conveyors, and *The Slatveyor* range of slat conveyors. The present survey deals mainly with *The Loadaveyor* type of handling equipment; other types of Collis mobile conveying equipment may be described on another occasion.

The Loadaveyor type of conveying equipment is available in a wide range of standard machines, as flat belt conveyors or slat conveyors, with fixed or variable delivery heights with unit load capacities of 1 or 2 cwt, and with distributed load capacities of 3 or 6 cwt, according to type, and belt speeds of 40 ft/min to 70 ft/min. A large variety of custom-built machines within this range has also been produced and many of these specially designed machines are generally applicable within industry.

Standard machines are made from standardized components, in three main types of construction, as follows:—

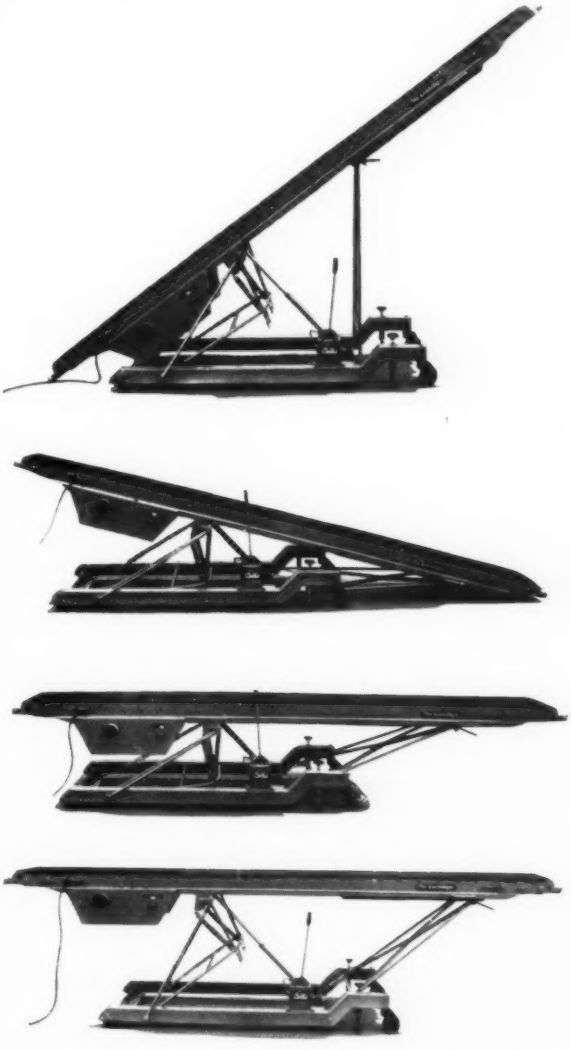
(1) Universal mobile conveyors, the booms of which may be hydraulically and manually raised and lowered for elevating and delevating duties respectively as shown in Figs. 1 and 2, in addition to this, they may be operated as horizontal conveyors of adjustable height as shown in Figs. 3 and 4.
(2) Restricted movement mobile conveyors with pivoted booms and hydraulic or manual delivery height adjustment as shown in Figs. 5 and 6.
(3) Fixed delivery height mobile conveyors as shown in Figs. 7 and 8.

It is also possible to obtain *The Loadaveyor* belt or slat-type boom units for location according to the users specific requirements.

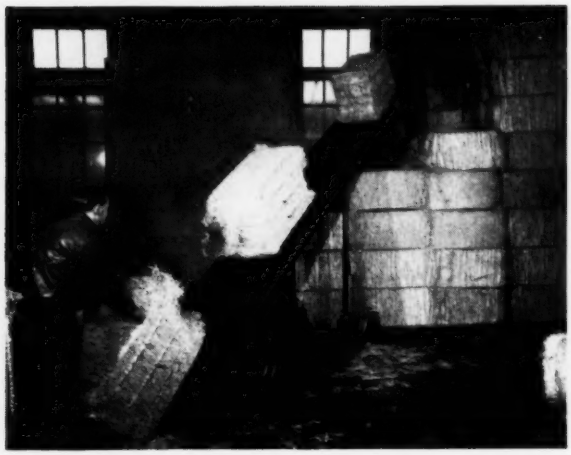
Belt-type machines within *The Loadaveyor* range are suitable for the handling of cartons, bags, packages and small components. Standard belts are of abrasion-resisting rubber 12, 18 and 24 in wide and run on ball-bearing mounted roller beds as shown in Fig. 9. Alternative belts, available as optional extras, include the following: white cotton ply; solid woven cotton; plastic faced cotton; bitumen impregnated cotton; tasteless white rubber; totally enclosed (abrasion resisting) rubber; heat-resisting rubber impregnated cotton; oil-resisting rubber; heat-resisting asbestos impregnated cotton; and grip-faced rubber. For steep angle loading duties, belts may be fitted with hard moulded rubber upstands at any required pitch, as shown in Figs. 10, 11 and 12.

Slat-type machines employ endless roller chains with wooden, steel or light alloy slats, together with upstands, if required. Slat widths are 12, 18 or 24 in. Typical examples are shown in Figs. 7, 8, 13, 14, 15 and 16.

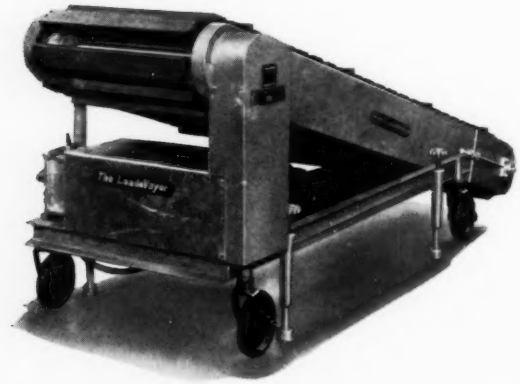
The Loadaveyor Standard Universal-types are available with 14-18 ft booms for belt conveyor machines, and with 14-16 ft booms for slat conveyor machines. Standard restricted-movement type *Loadaveyors* and fixed delivery



Figs. 1, 2, 3, *and* 4. *'The Loadaveyor', universal-type, mobile belt conveyor with manual and hydraulic height adjustment, showing the boom elevated and arranged for horizontal operation at two different heights from the ground*



Figs. 5 and 6. 'The Loadaveyor', restricted movement type, mobile belt conveyor, showing its dual warehouse functions, loading wood wool bales (in this case) from floor level to lorry, and from stock to floor level. This machine has hard rubber upstands and is capable of steep angle operation, and it is reversible



Figs. 7 and 8. 'The Loadaveyor' fixed delivery height, mobile slat conveyor. This machine is suitable for use in dairies and cold stores and is galvanized throughout. It has hard wood slats fitted with upstands at intervals, as shown

height *Loadaveyors* are available with 14-25 ft booms for both belt conveyor and slat conveyor machines. Separate self-contained boom units are available in lengths of 12-30 ft. The maximum angle of inclination for variable delivery height machines is 35 deg and the range in horizontal working height which is available in the case of universal type machines is from 32-42 in. Minimum feeding height is 7 in for belt-type machines and 10 in for slat-type machines.

The Loadaveyor standard range is available in two load capacity categories. These are:—'Type A' machines, designed for 3 cwt distributed loads and 1 cwt unit loads; and 'Type B' machines, designed for 6 cwt distributed loads and 2½ cwt unit loads. Slat conveyor machines are available with one of three alternative conveyor speeds: 40 ft/min or 50 ft/min or 60 ft/min. Belt conveyor machines are available with speeds of 50 ft/min or 60 ft/min or 70 ft/min.

Mobile conveyors and loaders made by J. Collis & Sons, Ltd., incorporate a number of interesting design features, many of them for promotion of easy operation, others to enhance safety. Belt tensioning, for example, is easily adjusted from outside the driving unit, by means of an adjusting screw at the side of a machine. Belt tracking is adjusted by means of correctors or take-up screws, which are fitted at each end of the boom. The conveyor sides are fully enclosed for neatness and prevention of hazards associated with exposed chains or rollers.

Standard machines are mounted on two rubber-tyred castors at the front, and two rubber-tyred wide-flanged ball-bearing wheels at the rear, and are easily moved into position by one man. They are fitted with screw-down sprags with self-locating shoes, for levelling on uneven floors and to enable machines to retain their working positions. Variable discharge height models employ Collis manually operated double-acting hydraulic pump units, lowering by means of well-positioned release valves, the booms being secured in position by one-handed operation of quick-action locking clamps.

The Loadaveyor spring-assisted 2-wheel chassis type is a simplified version of the 4-wheel chassis type and is popular for loading and off-loading vans, trucks, wagons, etc. It can be moved quickly into position and with a single adjustment the spring compensated boom can be set at the desired angle.

The low feeding height allows loads to be run direct on to the belt from trucks, and at the maximum angle of inclination a 22-ft boom will deliver up to a height of 11 ft 9 in. The geared electric motor with precision chain and sprocket drives a continuous belt running on a roller bed, providing a suitable surface for carrying cartons, bags, packages, small components, etc.

In the spring-assisted 2-wheel chassis type the belt carrying

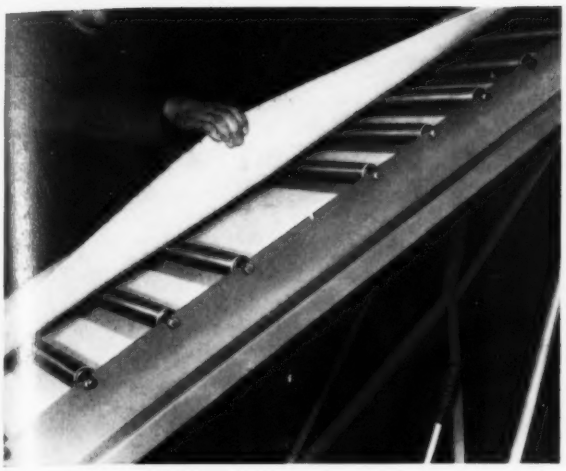


Fig. 9. Roller bed of 'The Loadaveyor' mobile belt conveyor showing one roller removed

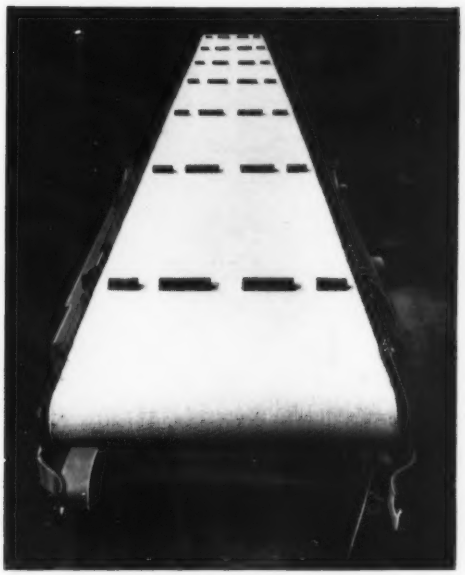


Fig. 10. Solid woven cotton belt and hard rubber upstands as used on 'The Loadaveyor'. A wide range of alternative belts is available, upstands being optional throughout

Fig. 11. 'The Loadaveyor', standard-type universal movement belt conveyor with hydraulic height adjustment and grip-faced rubber belt with hard rubber wide pitched upstands, at maximum angle of inclination

boom is mounted on a V-type tubular frame running on two large air-cushion tyred wheels, the tyres of which do not require re-inflation. Easy to manœuvre, stability and smooth running is ensured over rough surfaces.

Large compensating springs assist the adjustment of the angle of the boom. A pull on the operating handle releases the catch and the V-type chassis can be closed up to increase the angle of inclination or opened up to reduce the angle. When the handle is released the locking device ensures the positive positioning of the boom at all angles.

Loading capacities are: distributed load 3 cwt, unit load 1 cwt. Belt speeds 50 ft/min which can be varied if required.

Fig. 13. 'The Loadaveyor', restricted movement, slat-type conveyor with hydraulic height adjustment, heavy-duty fabricated steel carriage base, hard wood slats, widely pitched upstands. This conveyor is controlled by means of switches at upper and lower ends

Fig. 12. 'The Loadaveyor', universal movement mobile belt conveyor with hydraulic height adjustment, fully galvanized steelwork, feed hopper and side guards. This machine has a grip-faced rubber belt and hard rubber upstands which are pitched more closely than those shown in Fig. 11

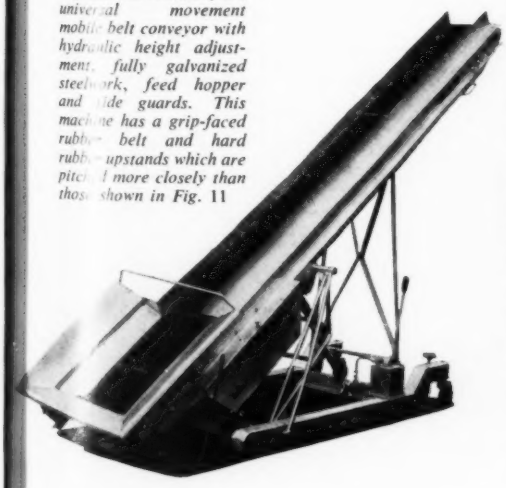


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Fig. 14. *'The Loadaveyor', restricted movement, slat-type conveyor with winch operated height adjustment, hard wood slats and angle steel upstands*

Fig. 15. *'The Loadaveyor', fixed-type slate conveyor with side rails*

Fig. 16. *'The Loadaveyor', universal movement, slat-type conveyor with manual and hydraulic height adjustment, hard wood slats and wide pitched angle-steel upstands*

Fig. 17. *'The Loadaveyor', universal-type mobile belt conveyor with grip-faced rubber belt and upstands, loading an outdoor lorry with animal food in paper bags, from ground level*

17

Boom lengths: 12 ft minimum increasing in increments of 2 ft up to 22 ft. Standard belt widths: 12, 18 and 24 in. Angle of inclination: 10-30 deg; loading height, $9\frac{5}{8}$ in.

Geared constant speed drip-proof $\frac{3}{4}$ h.p., electric motors are employed throughout. In the case of belt conveyors, these drive slatted steel positive-grip crowned driving drums through roller chain and sprocket mechanisms. The snubbing rollers are of large diameter and run on ball-bearings. Various optional extras are also available. These include totally enclosed electric motors, reversing gears with magnetic brakes for heavier loading, hoppers, side guards, side rails, weather-proof finishes, remote control gear, and couplings for use with other types of Collis conveyor.

Examples of Application

Examples of *The Loadaveyor* for standard application are shown in Figs. 17 to 23. Fig. 17 shows animal food packed in paper bags, being loaded on to a lorry from ground level at a country depot, using a grip-faced rubber belt with upstands. This type of belt will handle paper bags without risk of tearing. Fig. 18 shows the same machine at work inside another building. Because of its lightness and mobility and its ability to function as a horizontal conveyor of variable height as well as a reversible elevator, machines of the type shown are invaluable in simply constructed storage sheds, where occasional loading, stacking, de-stacking and handling from one level to another during processing or packaging, are called for. In many of the smaller establishments, one machine may be sufficient for all handling tasks. Fig. 19 for example, shows the machine illustrated in Figs. 17 and 18, handling sacks of cereal in a small milling depot at the same site.

For the handling of certain types of loose bulk material, inclined conveyors with rubber or canvas belts and upstands are ideal for feeding overhead hopper and processing equipment. A case in point is *The Loadaveyor* shown in Fig. 20. This belt conveyor is fitted with hopper and side guard and is seen conveying loads of flock up to baling press height. This machine, too, is a universal-movement machine, and it can handle a wide range of other materials of a generally similar constitution, e.g., bundles of wood-wool, bales of straw, leather hides, etc.

An important advantage associated with the use of universal-movement mobile conveyors is the ability to employ these machines in warehouses and works for vehicle loading and other duties without ordering custom-built machines, where a variety of different levels require mechanical bridging. Three examples of application shown in Figs. 21, 22 and 23 refer to three different establishments. In each case *The Loadaveyor* used is a universal-movement belt type fully mobile conveyor and was employed rather than other types of possible equally suitable equipment, because of *The Loadaveyor* universal-movement's ability to cope with the handling problems shown and a large number of others as well. A hypothetical example could be given, based on the three applications illustrated.

In Fig. 21, cartons of consumers goods are being loaded from *The Collis Truck* and platform on to a lorry, backed into a despatch bay. *The Loadaveyor*, shown in this illustration is a universal-movement type machine with grip-face belt, employing a stanchion-mounted electric power socket provided for the purpose, near at hand. In Fig. 22 a similar machine is loading wooden crates of bottle confectionery on to a lorry from a despatch bay through a roller shutter opening. The floor of the loading bay could in such a case be below outside ground level without disadvantage. In Fig. 23 a similar machine, this time with upstands, is being used to link runs of *The Rolaveyor*, an improved type of gravity roller conveyor, at two different floor levels, the items handled being packed television sets.

Now, if all three types of handling operation were called for in a particular warehouse and each of them was likely to be required for certain periods only, it might well prove practicable to employ the same machine for all requirements. In such a case, employment of one machine would be justified if no difficulties existed in moving the machine from site to site, i.e., if the journey from point to point was not excessively long or physically obstructed.

Fig. 18. The machine shown in Fig. 17 is also used for loading lorries within another building

Fig. 19. The machine shown in Figs. 17 and 18 is also used to stockpile sacks of cereal in the milling department of the same establishment

Of course, if one of the applications required a machine to be present continuously, it might pay to purchase one conveyor for that operation only, and this might be a universal-movement machine, a restricted-movement machine, a fixed discharge height machine or even a specially designed custom-built machine, according to specific handling requirements and handling economics.

Special Purpose Mobile Conveyors

A wide variety of non-standard and custom-built electrically operated mobile conveyors are manufactured by J. Collis &

Fig. 20. Handling flock from ground level to baler with the aid of 'The Loadaveyor', universal movement, mobile belt conveyor, fitted with a loading hopper and side guards

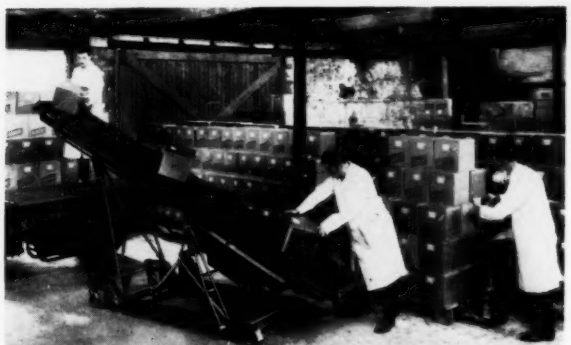


Fig. 21. Loading a lorry with cartons of consumers goods from a stillage truck directly, using 'The Loadaveyor', universal movement conveyor. In practice this could be done by two men

Fig. 22. Loading a lorry with wood crates of bottled confectionery through a roller shutter door opening, with the aid of a machine similar to that shown in Fig. 12 and 'The Rolaveyor' delivery section within the lorry. Both have grip-faced rubber belts

Fig. 23. Elevating packed television sets from 'The Rolaveyor' gravity roller conveyor at one floor level, to a similar conveyor at an upper floor level, with the aid of a steeply inclined universal-movement 'Loadaveyor' mobile belt conveyor with grip-faced rubber belt and upstands

Fig. 24. 'The Loadaveyor' 2-wheel chassis type is mounted on air-cushion tyres and is a simplified version of the 4-wheel chassis type

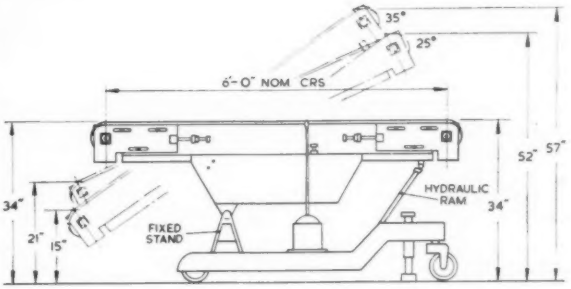
Sons, Ltd. Some of these machines have proved so popular as to tempt the author of this survey to regard them as additions to the range of standard Collis machines. A case in point is the swan-necked fixed boom slat type *Loadaveyor* shown in Fig. 25. This conveyor has a delivery height of 10 ft from ground level to the upper floor to be serviced and is for use in a large food warehouse. The conveyor is designed for a maximum total distributed load of 3 cwt and a maximum unit load of 1 cwt. It is electrically driven with rear pneumatic tyre wheels and front swivelling rubber-

Fig. 25. Collis slat-type fixed boom swan-necked 'Loadaveyor' mobile conveyor with hardwood slats and angle steel upstands, for the handling of groceries in a large warehouse

covered castors, and has 18-in hardwood slats with angle steel upstands at 6 ft pitch. The conveyor runs at 50 ft/min and is reversible. It is inclined at 30 deg, and has a loading height of 20 in the off-loading end being designed to protrude through 36 in aperture, 34 in high, and with a delivery height 14 in above upper floor level, as shown in Fig. 26, which gives leading dimensions of this machine.

Interesting custom-built machines of *The Loadaveyor* type have also been made. These include very short conveyors, long-boom conveyors, etc. Fig. 27, for example, shows the general arrangement of a mobile belt conveyor, custom-built for a user requiring a 6-ft machine. The machine illustrated has a variable discharge height ranging from 34-52 in at an inclination of 25 deg and 57 in at an inclination of 35 deg corresponding loading end heights being 34, 21, and 15 in. It has manual-hydraulic height adjustment and is mounted on rubber-tyred wheels and castors as shown. The belt is 18 in wide and runs at only 15 ft/min, maximum total distributed load being 3 cwt and maximum unit load 1 cwt. Fig. 28 shows a specially designed high maximum delivery height slat type, restricted movement model of *The Loadaveyor*, for working between a lorry tailboard and a first floor store. The conveyor has a similar load capacity to the machine shown in Fig. 27 and has a 9 ft length between centres, 24-in slat width, hardwood slats, angle steel upstances at 3 ft pitch, 35 deg maximum inclination, Collis manual-hydraulic height adjustment, maximum discharge height of 11 ft and minimum discharge height of 8 ft corresponding loading heights being 6 ft and 7 ft. The conveyor runs at 60 ft/min and is mounted on a tall superstructure with front and rear rubber covered swivelling castors 6 in dia and two screw-down stabilizing sprags.

Another interesting machine is the simple fixed discharge height short length slat model of *The Loadaveyor*. This is 7 ft long and has 18-in hardwood slats. Conveyor speed is 50 ft/min, loading height is 14 in and discharge height 4 ft 8 in. The machine is mounted on front pneumatic-tyred wheels and rear swivelling castors, and is designed for maximum distributed load of 6 cwt and a maximum unit load of 2½ cwt. A slat-type variable discharge height model of *The Loadaveyor*, specially built to provide dual applications in a particular establishment, has also been produced. This conveyor was required to carry out elevating and lowerating duties between one floor and another, through two different floor openings at different levels, one 9 ft 10 in above lower level, the other 11 ft 6 in above lower floor level.



ABOVE
Fig. 27. The belt-type 'Loadaveyor' mobile conveyors can be obtained with very short centres

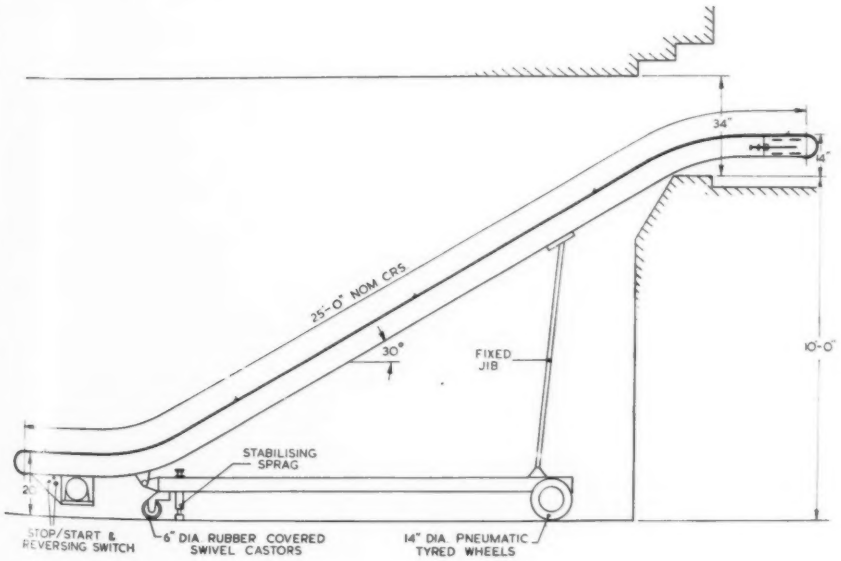


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Fig. 26. Leading dimensions and clearance requirements for the swan-neck conveyor shown in Fig. 25

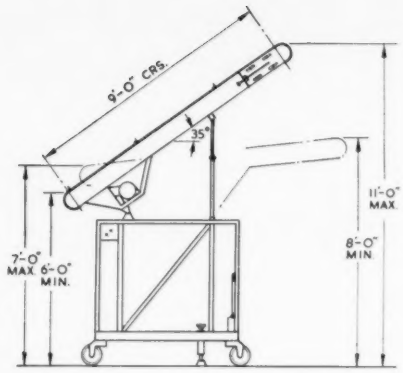


Fig. 28. Special 'Loadaveyor' with high delivery feed for elevation of goods from lorry tail board to a first floor store

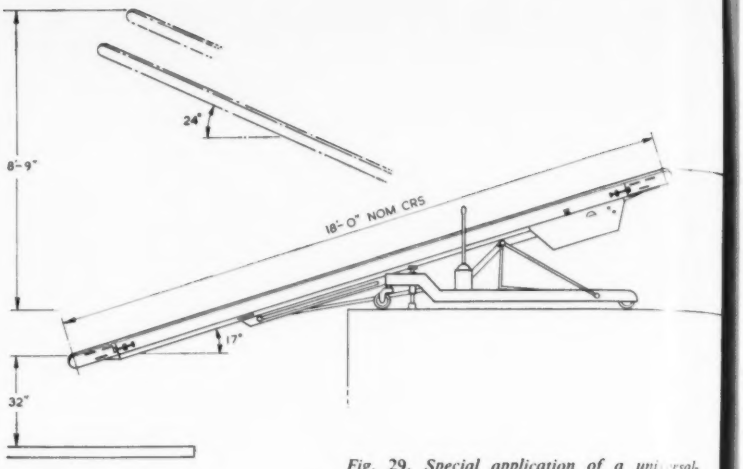


Fig. 29. Special application of a universal-movement belt-type 'Loadaveyor' mobile conveyor with details of off-loading requirements

This machine, although custom-built, very largely employs standardized equipment, one of the advantages, as it were, 'ringing the changes' on standard machines and making use of standardized mobile conveyor components. The conveyor runs at 60 ft/min and handles maximum unit loads of 1 cwt. It has 18-in slats and upstands at 3 ft pitch. The conveyor is 16 ft long and maximum recommended inclination is 38½ deg. It is hydraulically raised and lowered through two rams, and may be reversed, and is based on a specially built castor-supported stand.

A special application of *The Loadaveyor* is illustrated in Fig. 29. This is a 24-in belt conveyor of 60 ft/min speed and 18 ft between centres, with manual-hydraulic discharge height adjustment and employed for a range of duties requiring the boom to be variable at will between 17 deg below the horizontal and 24 deg above it, corresponding to the dimensions given in the drawing. Another conveyor had to be counter-balanced by means of a ballast box located within the castor-mounted base frame. The conveyor is designed for a maximum load of 5 lb/sq. ft. and employs white plastic belting, 24 in wide, running at 50 ft/min. This custom-built model of *The Loadaveyor* is designed to span the gap between two machines in the user's works. The conveyor is 16 ft between centres and underside clearances are 48 in at the loading end and 56 in at the discharge end, and there are 4-in high sideguards along its full length.

Three other examples are worth brief mention. There is a large slat type *Loadaveyor* with 32 ft adjustable boom, 24-in slats, 60 ft/min conveyor speed, 6 cwt maximum distributed load, 2½ cwt maximum unit load, upstands at 4 ft pitch and 35 deg maximum recommended inclination, maximum discharge height being 27 ft and height adjustment being by means of a manually controlled sliding jib operated by wire and pulley mechanism as shown. Longer slat conveyors are also available, a typical example having a 36-ft fixed boom, 48-in slats, upstands at 4 ft pitch, 22 ft discharge height, and employs a supporting jib type structure for the boom support. This machine is of the same load capacity as the previous example.

The Loadaveyor shown in Fig. 30 is a custom-built belt-type for 3 cwt distributed loads and 1 cwt unit loads, with an 18-in belt, 60 ft/min belt speed, reversible control, hydraulic height adjustment and an additional telescopic locking jib which locks the boom in any selected position between maximum and minimum discharge heights of 14 ft and 5 ft respectively.

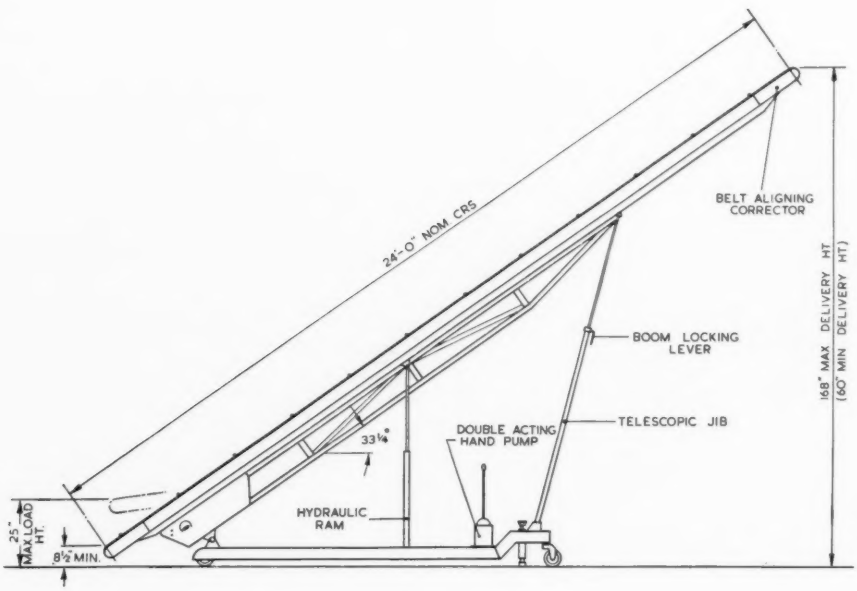


Fig. 30. Belt-type 'Loadaveyor' with hydraulic boom control and telescopic locking jib

Fig. 1. Tesco House, the new headquarters of Tesco Stores, Ltd., at Cheshunt

HANDLING STORES FOR SELF-SERVICE

Modern Methods and Equipment for High-speed Distribution at Tesco Stores, Ltd.

By a Special Contributor

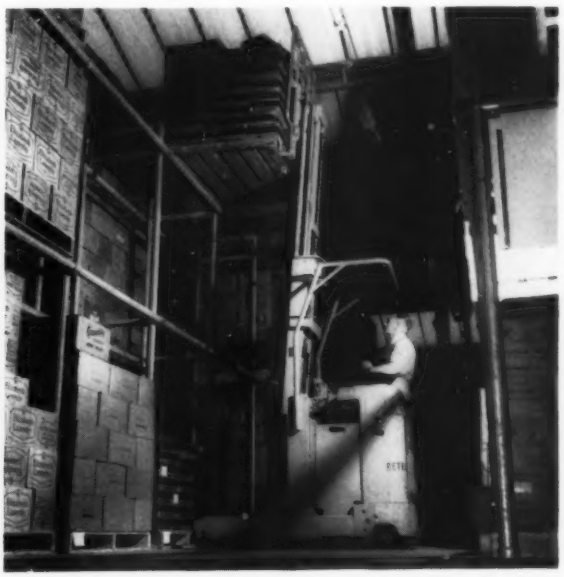
At the official opening recently of the new headquarters and warehouse of Tesco Stores, Ltd., those present were reminded that from the commencement, some thirty years ago, of the business, the company's policy has always been to provide the best for less. Though this slogan has generally been understood to relate to competitive prices to the public, the equipment and layout of the new warehouse, methods of handling the stores supplied and system of control adopted, justify its reference also to the saving of time and labour achieved throughout the whole process, from reception of stores to their loading for delivery to more than 150 Tesco retail supermarkets and self-service shops. The organization and facilities provided have been planned not only to meet existing commitments, but to include the requirements of a considerable expansion of the business for which extension of the warehouse on adjoining land is envisaged.

Tesco House, the two-storey headquarters building, comprising offices, boardroom, packaging department, printing room, Hollerith room, dining hall, kitchen and first-aid room, covers some 25,000 sq. ft. The adjoining food warehouse of about 7,500 tons holding capacity, said to be the largest in the country, is a single-storey structure of 104,000 sq. ft. floor area. At one end there is also a refrigerated store of 30,000 cu. ft. capacity for fats and cheeses. The rest of the warehouse is heated to about 50 deg F by a modern steam plant also supplying hot water wherever required.

Home-produced and imported goods handled range from packaged groceries and provisions to fresh meat, fruit, vegetables, including cucumbers and tomatoes grown in the company's nurseries at Cheshunt, clothes and drapery. About 200 tons of foodstuffs are cleared from the warehouse daily. To keep down warehousing and distribution

Fig. 2. Goods on pallets being taken off a lorry with an Amies fork lift truck under cover in the unloading area

Fig. 3. Stacking heavy pallet loads on three-tier racking



costs, the warehouse was planned for highly mechanized handling and fast throughput. Similar operations in Britain and the United States were studied, and time and motion experts were also consulted before its layout and equipment were ordered.

An unusual feature of the warehouse is that there are no loading and unloading bays at vehicle platform height. All loads are handled at ground level. Lorries bringing supplies are driven on to the reception area at one end of the warehouse and are backed into the unloading area inside the building. There they are unloaded by means of a fleet of seven Amies electric reaching and retracting fork lift trucks. In bad weather roll shutters at the entrances are closed down so that the warehousemen and drivers work in comfort and the goods are not exposed to the weather.

The goods are first taken by the trucks to the adjoining free-stacking area where the reserve stock is held, the larger and heavier loads on one side and the smaller and lighter in line across a gangway on the other. All consignments are checked in, and the subsequent location of each load is indicated by a red marker disc hung on a large-scale operational plan in two vertical counterbalanced sections that can be raised for easy access and reference.

From the free-stacking area the heavier stores are taken, as required, by fork lift trucks directly across a gangway and placed on three-tier adjustable Kee Klamp tubular-steel racking manufactured by the George H. Gascoigne Co., Ltd. The racking covers an area of 26,000 sq. ft., and intersecting gangways give immediate access to every rack load. Similarly, the light goods are fed into light three-tiered bins supplied by the Norwood Steel Equipment Co., Ltd., and occupying 11,000 sq. ft.

The Hollerith punched-card system is employed for automatic invoicing and production of order forms which are distributed to the loaders, who select goods from the ground floor and bins and convey them to the loading area by

Fig. 4. Loading one of the Tuglift hand trucks by which consignments for the stores are taken to the loading area

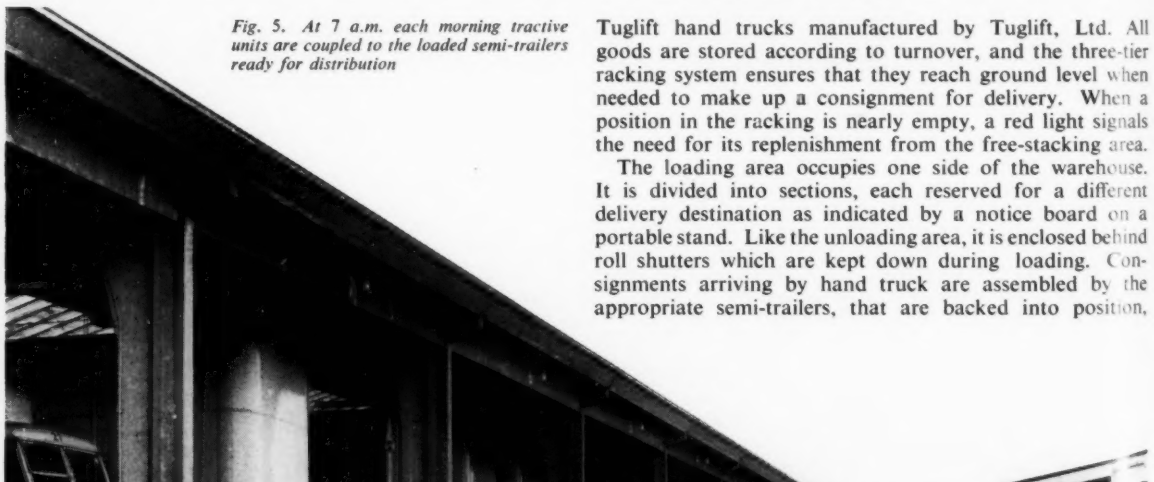


Fig. 5. At 7 a.m. each morning tractive units are coupled to the loaded semi-trailers ready for distribution

Tuglift hand trucks manufactured by Tuglift, Ltd. All goods are stored according to turnover, and the three-tier racking system ensures that they reach ground level when needed to make up a consignment for delivery. When a position in the racking is nearly empty, a red light signals the need for its replenishment from the free-stacking area.

The loading area occupies one side of the warehouse. It is divided into sections, each reserved for a different delivery destination as indicated by a notice board on a portable stand. Like the unloading area, it is enclosed behind roll shutters which are kept down during loading. Consignments arriving by hand truck are assembled by the appropriate semi-trailers, that are backed into position,

Fig. 6 (above). Gascoigne heavy steel tubular racking in the warehouse

Fig. 7 (left). Norwood steel bins for light goods

Fig. 8. A gangway in the warehouse, showing numbered positions of stores on pallets in the free-stacking area and heavy racking in the background

and are checked by a supervisor as they are loaded by twelve Fourways electrically operated slat conveyors, supplied by Fourways (Engineers), Ltd., reducing manual labour to a minimum. A Yale Worksaver electric truck, made by the Yale and Towne Manufacturing Co., is employed to take fats and cheeses from the refrigerated store direct to the loading area. In a special department next to this store dried fruit and cereals, bought in bulk, are packaged. The dried fruit is machine-cleaned and, like the cereals, packed by machine into Cellophane containers which are sealed, placed in cartons and taken direct to the free-stacking area.

The Tesco fleet of road motor vehicles comprises two Leyland, two Guy and eight Ford diesel-engined tractive units drawing B.T.C. semi-trailers having capacities of 10 to 15 tons, nine Albion petrol-engined 6-ton and three Bedford diesel-engined 5-ton lorries. Also in use on trial is a York Freightmaster 14-ton frameless lightweight semi-trailer produced by the York Trailer Co., Ltd. These carry to and from the Cheshunt warehouse little more than half the total quantity of stores distributed to the Tesco stores and supermarkets, as the remainder is delivered direct by the suppliers. The lorries are mainly used for bringing in the stores and the articulated vehicles for distributing them. Some of the latter, however, are also employed for collecting heavy loads of imported goods.

For load handling in the warehouse a fleet of 125 Tuglift hand trucks are available. The number of pallets used is about 5,000, and to carry these wherever required are eight Omic Paliton hydraulic stillagers, supplied by Omic, Ltd.

Fig. 9. In the loading area where Fourways electric conveyors are used to load stores into semi-trailers

FREE MOVING EQUIPMENT FOR BULK MATERIAL HANDLING

A CEREMONY was held recently at the Camberley works of Michigan (Great Britain), Ltd., to mark the handing over of the 500th machine built by this company in Great Britain.

Early in 1958 Michigan (Great Britain), Ltd., announced the production of their first Michigan tractor shovel range. The Steel Company of Wales were the first purchasers in the United Kingdom, and after extensive use and scrupulous tests, they now own the largest fleet of Michigans in Great Britain. They have now bought two model 275A tractor shovels, the largest of their type in Europe, the first of these being the 500th Michigan built in Camberley.

At the handing over ceremony The Steel Company of Wales was represented by Mr. Henderson, chief mechanical maintenance engineer, and Mr. N. Dolling. A good deal of interest was aroused by a number of points made by Mr. Dolling during the course of a comprehensive statement under the title 'Free Moving Equipment for Bulk Material Handling', the greater part of which follows.

"Some four or five years ago we began to concern ourselves, at The Steel Co. of Wales, Ltd., in the possibilities of using ultra-large rubber tyred shovels as a material handling task force in and between the steel division's main stockyards. This was in keeping with a previous decision to 'go rubber tyred and get mobile' as a general overall policy on free moving mechanical handling equipment. This policy was enthusiastically supported by Mr. W. F. Cartwright, our assistant managing director.

We experimented with a number of shovels then available on the United Kingdom market but, while these proved the principle of mobility and flexibility, it was soon obvious that the machines were too small and not robust enough for industrial applications. We therefore drew up a specification of an ideal—though still hypothetical—rubber tyred shovel and then set about the task of finding one.

This took a considerable time and, after finally investigating the United States market, we found the Michigan range of tractor shovels which appeared to meet our requirements. A 175A tractor shovel was brought over from the United States and subjected to the most rigorous tests. Subsequently, two machines of this type, and later a further one, were purchased.

This was in the days before 'Michigan Great Britain' came into existence and you will therefore appreciate that Mr. Henderson and I have a very direct paternal interest in the company whose guests we are today.

When the first Michigan tractor shovels were put into service at The Steel Co. of Wales, Ltd., they looked very big indeed and very much out of place in a steel works. A great many unkind words were said about them and us by

Fig. 2. A Michigan 275A Supertractor at work

some of our colleagues in industry but, within a short time people from many parts of the world were coming to see our machines and there is ample evidence today that they profited by their visits.

As I have said, that was some years ago and since then we have acquired a fourth 175A and are now about to purchase two 275A's. This last 175A machine was completely British built and I am pleased to say that it is equally as good, if not better than its American counterparts.

The question is still often asked, however, why we need machines of this type in such an unconventional setting as a steel works. The answer is that it is one of our lines of thought in attempting to find a solution to one of the major problems of heavy industry today—that of bulk material handling. This problem has been brought to a critical stage as a result of present day demands for increased production but basically it is just about as old as man himself.

Indeed, it is probably true to say that the people who built Offa's Dyke and Stonehenge were just as worried about material handling problems as, for instance, the builders of the Chiswick Flyover. But by and large, loads were then moved by the direct application of human or animal muscle, whereas in modern and progressive industry human muscle is only used in this manner when the work to be done is of such a nature that a machine cannot be readily applied to it.

In heavy industry generally, mechanical material handling equipment has long been thought of as conveyor belts and transporter cranes etc., but in many cases these fixed installations are unable to cope with the changing pattern of modern day conditions as they are highly inflexible, difficult to replace in the event of breakdown, and installation costs can be considerable. This has created a need for free moving mechanical equipment in the present day industrial material handling field, particularly where large scale expansion is taking place.

In such undertakings it is essential that the material handling engineer should have systems and equipment capable of being moulded to a number of applications and able to cope with fluctuations in supply and demand. He must also have the facilities to cater for sudden changes in stockyard and warehouse capacity and to re-route flow lines at short notice.

Thus, flexibility, versatility and interchangeability have become essential weapons in the present day mechanical handling engineer's armoury and his greatest protection against the vicissitudes of his profession.

I have made previous reference to our ancestors' practice of applying human or animal muscle directly to the handling of materials and of course it is probably true to say that man himself is still the most flexible and ubiquitous piece of mechanical handling equipment available. However, the human mind and body should be used for greater things than pure physical work of this nature and, in any case, present day man has become one of the most expensive elements in the cost structure of industry and we cannot, therefore, afford to employ human muscle merely as motive power if we are to successfully manufacture and distribute goods in a competitive world.

There is a need, therefore, for design engineers to develop machines which are flexible, multi-purpose and, at the same time reduce human effort, thus providing industry with a means of obtaining high productivity from the labour available.

Until recently, very few types of free moving machines have been produced directly for material handling. Most of those used for this purpose had their origin in other branches of industry, particularly the civil engineering field or, even more specifically, earth moving. Nevertheless, these machines have been eagerly grasped by mechanical handling engineers, in a wide range of industries all over the world, as a possible solution to many of their problems.

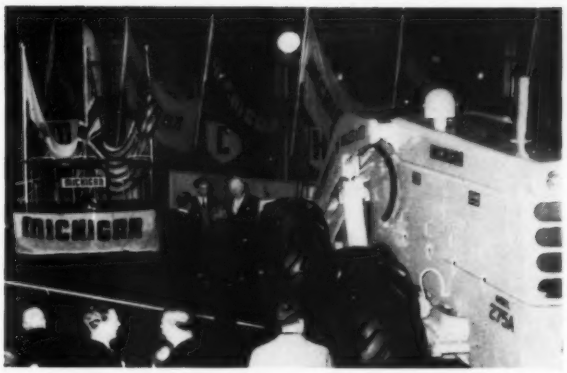


Fig. 1. The handing over of the 275A Supertractor—Michigan's 500th machine—to The Steel Co. of Wales. From left to right: Mr. H. Hounsell, general sales and service manager for Michigan (Great Britain), Ltd., Mr. N. Dolling and Mr. Henderson of The Steel. Co. of Wales and Mr. A. J. F. Andrews, managing director of Michigan (Great Britain), Ltd.

This is particularly so in undertakings—such as our own—using large quantities of bulk raw materials, where large scale stock piling has become the order of the day to combat costly production stoppages caused by interruptions of supply resulting from hold-ups in shipping, road or rail transport and, of more recent years, in lightning or long term strikes in the producer industry or transportation services.

Unfortunately, however, we found that in many cases these machines were not up to the demands and hazards imposed by continuous operation under incentive conditions and I have little doubt that attempts in the past to introduce earth moving types of equipment in to industrial material handling applications for which they were not suitable did much to create the lack of confidence in these machines that undoubtedly persists in many quarters today.

The weaknesses and defects referred to were apparent not only in machine design and construction but also in components such as engines, transmissions, hydraulics and tyres. In these units the ratio between engine b.h.p. and gross machine weight was often unsuitable, 'hot shift' gearboxes were almost unheard of and fluid transmissions combined with four wheel drive were either too costly or unreliable.

Hydraulic pumps, rams and hoses were prone to frequent breakdown and pneumatic tyres—which are the 'Achilles heel' of rubber tyred machines—were not available on the United Kingdom market in appropriate size, ply rating or tread design.

Happily, some companies have taken it upon themselves to introduce new techniques and manufacturing methods, as a result of which the products they are offering today are robust, reliable and capable of high productivity over prolonged and continuous working periods. In this connection our own company has also played its part by introducing Corten steel which is now widely used by manufacturers of heavy duty earth moving and civil engineering equipment.

In spite of the improvements in construction however, we still feel that machine manufacturers can do much to help themselves, and us, by encouraging their salesmen and engineers to learn more about heavy duty industry and its problems and to realise that bad sales and indifferent service can damn not only the machine but the whole principle of application.

Some manufacturers and distributing organisations have already taken a step in this direction by setting up 'industrial

applications' sections within their sales engineering force which, in itself, is good but I would stress that, if it is to be successful, there must be a real attempt to co-operate with industry and produce its needs. Mere lip service will end in almost certain disaster for customer and supplier.

At The Steel Co. of Wales, Ltd., we have pioneered many new material handling applications involving the use of mobile plant machines, some of which were previously completely unknown to the steel industry in this country. Our use of this type of equipment now extends into all sections of the steel division, including production processes and maintenance work. For example: the slag from the two biggest blast furnaces, which are amongst the largest in the world, is cleared from the slag pools by face shovels.

The open hearth slag pockets at Abbey, Margam and Port Talbot melting shops are cleared by tracked shovels and at Abbey the slag-pot carriageways are also cleared by these machines. The whole of the division's scrap stock of up to 90,000 tons is handled to and from stock by mobile cranes equipped with magnets.

Our main coal stockyard, holding up to 120,000 tons, is operated by scrapers and rubber-tyred shovels which have met the full coke oven consumption of over 5,000 tons/day. The main raw materials stockyard, holding up to a quarter of a million tons, is operated entirely by mobile plant of various types.

Most of the internal movement in the existing ore stockyards is carried out by rubber-tyred shovels, although material is transported to and from these yards by conventional transporter cranes and conveyor belts.

A new fine ore open stockyard, capable of holding over 250,000 tons, is shortly to be commissioned and this will be operated by scrapers and rubber-tyred shovels without the assistance of fixed installations. Plans are also in hand for a similarly operated open stockyard for rubble ores.

Open hearth furnace demolition work at Margam and Port Talbot is now carried out by civil engineering plant with remarkable improvements in furnace turn-round and savings in manpower. In addition to the above-mentioned operations, most of our finished products from the cut-up lines are handled by straddle carriers and numerous other machines, such as fork trucks, dumpers and mobile and rail cranes, are used throughout the works on engineering and maintenance duties.

From these examples you will note that the rubber-tyred shovel and scraper are much in evidence as bulk raw material handlers and we consider that these machines have an important part to play in this role in the future.

In heavy industry generally, however, we feel that there is still a great potential for mobile plant which is, as yet, almost untouched. It is hoped that machine manufacturers will give this rather more attention than in the past, as users such as ourselves will indirectly benefit from the greater sales of their products.

We have great faith in the ability of free-moving equipment to carry out material handling applications efficiently and economically. I trust that by illustrating some of our problems and their possible solutions, machine manufacturers will be encouraged to give greater consideration to our requirements and those of heavy industry generally".

NEWS OF PERSONALITIES

Consequent upon the continued expansion of the company, and in recognition of their part played in this progress, the governing directors of Lansing Bagnall, Ltd., have appointed **H. P. Mott, M.I.Prod.E.,** and **J. B. Peat, A.C.A.,** company secretary, to be associate directors. Mr. Mott has for the last five years been responsible for production of the company's range of industrial trucks, while Mr. Peat has held the appointment of chief accountant since 1951.

H. P. Mott

C. W. Reester, the general manager of Mortimer Eng. Co. for many years, has now been appointed to the board of directors of S. Guiterman and Co., Ltd., proprietors of Mortimer Eng. Co.

D. N. Steeley has been appointed sales manager of Standard Industrial Motors at the G.E.C. Engineering Works, Birmingham. Mr. Steeley was educated at Repton and joined The General Electric Company Limited as a student apprentice in 1949.

T. M. Horn has retired from the position of manager of the Leeds branch of Atlas Copco (Great Britain), Ltd. **A. W. Tombleson,** from the firm's Manchester branch, has been appointed to succeed him. Concurrent with this change, the existing Leeds area has been divided and a new branch office is being established in Newcastle. The branch manager in Newcastle will be **W. Hossent.** Head office of Atlas Copco (Great Britain), Ltd., is at Maylands Avenue, Hemel Hempstead, Herts.

Kenneth Baird has been appointed personnel manager of F. Perkins, Ltd., of Peterborough. Mr. Baird, who is 37, has been head of the Industrial Welfare Society's education and training department since 1955. He was previously

Kenneth Baird

Leslie Williams

personnel and training officer with Rotax, Ltd., a subsidiary of Joseph Lucas, Ltd., and personnel officer of Kodak, Ltd.

Sheepbridge Stokes, Ltd., of Chesterfield, Derbyshire, a member company of the Sheepbridge Engineering Group, announce the appointment of **J. C. Morton** as their technical representative in the north and east area from Lincolnshire to the Scottish border.

Mr. Morton, whose home address is 16 Ennerdale Crescent, Newbold, Chesterfield, will be responsible for promoting sales of the various Sheepbridge Stokes products. Their range includes centrifugal castings in grey and alloy irons, Centricast cylinder liners, and centrifugally cast rolls for the steel, paper, printing and other industries.

Leslie Williams has joined Frederick Parker Limited, as factory representative for Europe and the Near and Middle East. He will be based in London. Mr. Williams, who is 39, will be available to give advice on all major construction projects where Parker plant is being used.

Before joining Parkers, Mr. Williams had specialized in business with the Middle East. At one time, he was with the Supplies Division of the Colonial Development Corporation, working on plant procurement.

The **Hon. Francis Cumming-Bruce, C.M.G.,** who has been appointed High Commissioner for the United Kingdom in Wellington, New Zealand, and left England to take up his post at the end of last year, asked in Whitehall what he should see to extend his knowledge of the production methods of companies exporting on a large scale to that country. He was told that Simms Motor Units, Ltd., represented 'the spearhead of modern production methods'.

Accordingly, Mr. Cumming-Bruce, under the auspices of the Central Office of Information, made a thorough and extensive tour of the Simms Works in North London. He was received by Mr. G. E. Liardet, chairman of the company, and Mr. H. R. Daddow, works director, and such was his interest in the up-to-the-minute methods of Simms production, that in spite of a day full of pressing engagements he spent far more time at the Finchley factory than he had originally intended.

Mr. Cumming-Bruce, C.M.G., inspecting the automatic time control used on a high-frequency unit for induction hardening at Simms Motor Units Works in East Finchley. On the right, Mr. G. E. Liardet, Chairman of the company

Mr. Cumming-Bruce said he was impressed both by the speed and reliability of production methods and by works conditions in the factory.

L. A. Frankle, of Angel Truck Co., Ltd., was recently appointed President of the Truck and Ladder Manufacturers Association, in succession to **R. F. Hide,** of Hide & Clements, Ltd. The illustration below shows the new president and some of the members of the Council.

United Dominions Trust announce that **L. D. Warr** has been appointed a manager (New Business) of United Dominions Trust (Commercial), Ltd. He took up his new duties at UDT's head office on January 1st last and will be primarily concerned with finance for industrial plant and equipment.

Mr. Warr has been in Leeds as UDT's regional manager for the North-East since November, 1952. He will be succeeded by **G. H. Phillips,** whose place as branch manager in Birmingham is being taken by **J. H. Goldsmith** from UDT's Worcester office.

Truck and Ladder Manufacturers Association. President with some members of the Council at the Annual Dinner-Dance, Connaught Rooms

Reading from left to right. BACK ROW: *B. Ockenden, Secretary. F. Gough, Gough & Co. (Hanley), Ltd. J. H. Smith, J. H. Heathman, Ltd. P. R. Whittaker, Lyte Ladders, Ltd. A. C. Drew, Drew, Clark & Co., Ltd.* FRONT ROW: *T. W. Lane, Ladder & Fencing Industries (Longhope), Ltd. L. A. Frankel, Angel Truck Co., Ltd., President,. R. G. Milles, R. D. Milles, Ltd.*

OBITUARY

We regret to announce the death in Glasgow on December 24th of James Thomson, late conveyor engineer of Mavor & Coulson, Ltd.

James Thomson received his technical education at the Royal Technical College, Glasgow, now the Royal College of Science & Technology, and served his apprenticeship with three West of Scotland engineering firms. In 1917, he went to London and was engaged with a conveyor engineering firm as a designer and, later, as a contracts engineer, gaining wide experience.

In 1925, he joined the Conveyor Department of Mavor & Coulson, Ltd., and, with his deep knowledge of mechanical handling, saw that the troughed belt conveyor had much to offer the mining industry. In 1926, a troughed belt conveyor installation designed by him for conveying two hundred tons of coal an hour up a drift rising one in three at Bargoed Colliery, South Wales, was put to work successfully, making mining history ; the following year he designed and installed in a Leicestershire colliery the first troughed belt conveyor to connect an advancing longwall face with a fixed loading station.

In recent years and until his death, the services of Mr. Thomson were retained by Mavor & Coulson, Ltd., in an advisory capacity.

REVIEW OF NEW EQUIPMENT

Securing a carton on a Gerrard automatic wire tying machine

AUTOMATIC WIRE-TYING MACHINE

Cartons, cases or other packages of regular shape can be secured with two wires at the rate of four hundred/hr with the new automatic wire-tying machine introduced by Gerrard Industries, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex. It will tie sacks as small as 8 in × 9 in up to a maximum of either 16 in × 20 in or 17¼ × 18 in regardless of their length. It is powered by a ½-h.p. electric motor suitable for a 400-V three-phase 50-cycle current supply.

No skill is required to operate the machine, which is intended to form part of a packing flow line. The carton, or case, is pushed from a conveyor on to a table and under the ring as shown in the illustration, a pedal is pressed and in less than five seconds wire is wrapped around it, tightened, twisted and cut off automatically. Any number of wires can be added in other required positions by repeating the operation. The tie is as strong as the wire itself and lies perfectly flat without any protruding ends. The machine is designed for use with 15, 16 or 17 gauge high-tensile galvanized-steel wire, supplied in special 2,000-ft coils that are mounted within the machine, saving floor space and allowing the conveyor to be placed immediately against the machine table, thus facilitating movement and handling of the pack.

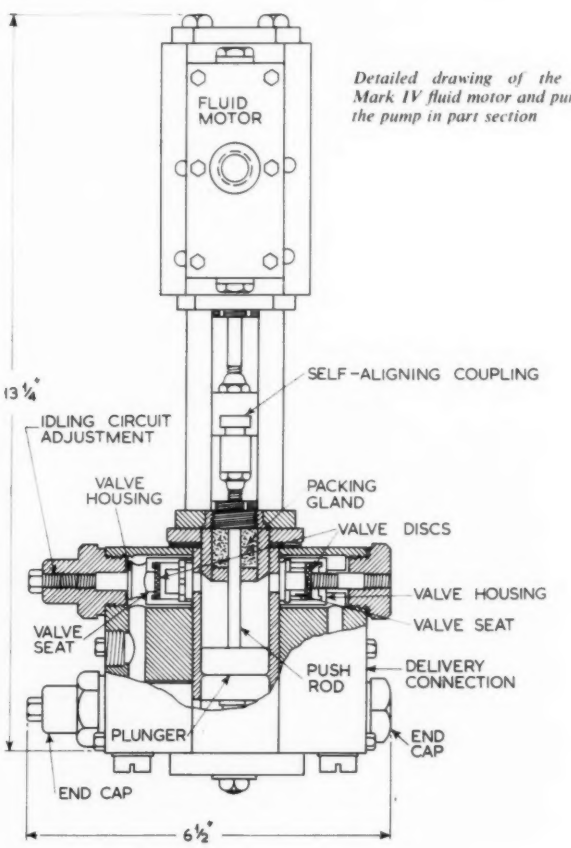
PNEUMATIC PUMP UNIT

A very wide field of industrial and other applications is available for the latest Neumo non-stalling reciprocating pneumatic pump unit developed by Neumo, Ltd., South Coast Road, Peacehaven, Sussex. Pumps are produced in P.T.F.E., polythene, stainless steel, corrosion-resisting alloys, non-ferrous materials, cast iron and steel. Coupled to an air line of 30-40 lb/sq. in. pressure, it can handle fluids of widely varying viscosities, ranging from those that must be kept scrupulously clean to those that are corrosive. Of the two models in production, the Mark IV can be supplied with extension rods up to 12 ft long between motor and pump so that the latter can be immersed in viscous liquids that render a suction lift undesirable. The Mark X is of similar basic design but has ten times the capacity. With an intermediate size in process of development and with pumps of various bore sizes the units can give progressive deliveries from 6 pints to 1,500 gal/hr.

The pump is of conventional double-acting, positive-displacement type, novel features being the design of gland packing to reduce shaft wear and ease of removal and maintenance. It has only two moving components, one piston and one valve, each in turn controlling the other. As it is necessary to have rising and falling pressures to change the direction of the valve and piston, it would seem that a balanced position between them would result when the motor is flooded by stalling under pressure, all pressures being equal. This, however, is not the case. No matter how slowly the unit is moving, the velocity of the valve change-over is practically constant. This is accomplished by a circuit that restrains the valve movement until the piston reaches a predetermined point. Before this is reached a high build-up of pressures attempts to move the valve. Thus, as soon as the piston reaches the required point, releasing the restraining pressure, the valve is moved at high velocity. In spite of this, should the movement be retarded by slight corrosion, dirt or similar conditions, the same circuit that restrained the valve movement can now thrust the valve fully home to its new position, securing it there against all vibration or changes of attitude. The piston will now, of course, change direction, continuing the cycle.

The simplicity of the unit gives a versatility that can be put to many uses. For example, proportioning of liquids one to another as distinct from metering, involving time, can be accomplished by harnessing motor units that can be termed slaves, by pipelines to one master unit. The master unit alone having a valve, the slaves are forced to accept pressure and exhaust from the master motor. Thus, although the slave units must run at the same speed as the master, there is no reason why the length of stroke of the slave units should not be controlled at will, thereby giving infinite and pro-

(*Continued on p.* 115)



Detailed drawing of the Neumo Mark IV fluid motor and pump unit, the pump in part section

gressive proportioning within the maximum capacity of the unit.

Neumo pump units are used for a circulation system in paint plants, handling shampoos, hair cream, penicillin, liquid gases for Aerosol packaging and butane gas. The stainless steel version successfully handles liquid sugar, chocolate, cream, jams and wines and, with a pump made entirely from fluon, hydrofluoric acid and the most difficult materials provided that they will flow.

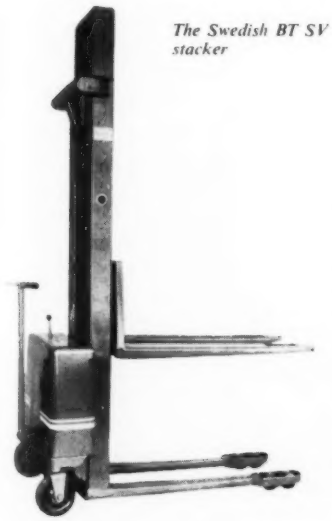
PNEUMATIC CONTROL VALVE

Included in the new range of Red Ring pneumatic valves manufactured by Stuart Davis, Ltd., Bayton Works, Bayton Road, Exhall, Nr. Coventry, is a robust five-port direct-operated double-solenoid model. This is particularly suitable for the control of air-line pressure to double-acting cylinders and devices where electrical remote control is required in dusty conditions or where a heavy-duty valve is essential. It is available for ¼-in and ½-in B.S.P. with solenoids wound for all standard voltages.

Direct-operated double-solenoid pneumatic valve recently added to the Red Ring range by Stuart Davis, Ltd.

ELECTRO-HYDRAULIC STACKERS

Now available in this country is a new range of stackers produced in Sweden. Known as the BT SV stackers, they are pedestrian-controlled with an electro-hydraulic lift, a capacity of 1,100 or 2,200 lb at a 24-in load centre and standard lift heights of 92, 108, 124 or 132 in. They have a turning radius of only 69 in, overall length of 63 in, including forks, and are particularly suitable for use where floor loading is restricted, having an unladen weight of less than 900 lb.



The Swedish BT SV stacker

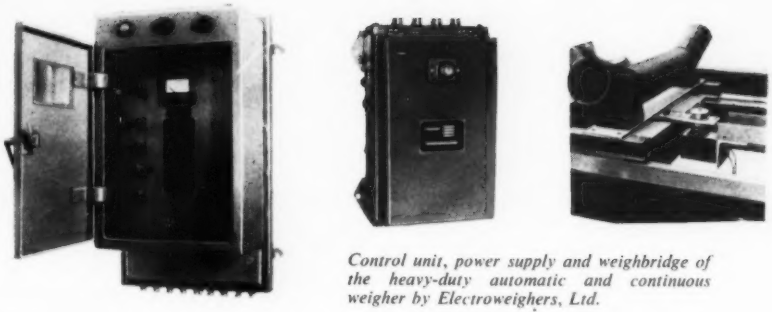
Maximum rigidity and strength under full load is achieved as all main components, such as mast, lifting forks, mast channels and support legs are one-piece high-tensile steel pressings. The hydraulic unit is completely leak-proof, incorporating special packing material to give long, trouble-free service. Lifting speed is 33 ft/min with the 1,100-lb model and 16 ft/min with the 2,200-lb model. Lowering speed is adjustable. Single, telescopic and free-lift masts can be supplied. Freedom from complicated mechanisms and clean styling make routine maintenance negligible. Wear in the lifting assembly can be taken up by adjustment of the carriage brackets and mast-channel guides. Good manœuvrability and effortless operation are provided by the fitting of SKF bearings and nylon-reinforced Bakelite wheels. Mains-operated or battery-powered models are available, and a manually operated hydraulic system can also be provided.

The U.K. distributors are Rolatruc, Ltd., 20 Old Compton Street, London, W.1.

ELECTRONIC WEIGHER

A heavy-duty automatic and continuous weigher for coal preparation, ore mining and quarrying applications is announced by Electroweighers, Ltd., Moseley Street, Birmingham, 12. The operating technique involves the use of a dust-proof load cell incorporated in a single idler weighbridge. The weight of the burden on the belt creates pressure on the cell electrically connected to a stable oscillator which, dependent on the load, induces an unbalanced voltage. This voltage, when amplified, is used to give direct readings of the momentary load. An additional voltage from a tacho-generator, driven on the return belt, is multiplied and integrated with the oscillator voltage. The total burden conveyed is indicated by counters and high accuracy is claimed. The bridge capacities are 20 to 20,000 tons/ht.

Initial rate and load calibration tests can be easily carried out by using a built-in calibration weight and an auxiliary counting device. The compact weighbridge is fitted between conveyor stringers, up to 30 deg inclination, and can be remotely connected as far as 100 yds from the electronic control unit. Additional remote recording or indicator instruments can be supplied, and special pre-selected batch loads and other check control equipment can be manufactured to suit individual requirements.

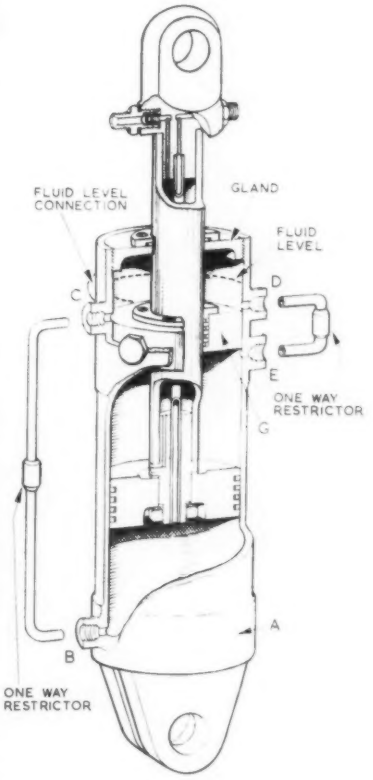


Control unit, power supply and weighbridge of the heavy-duty automatic and continuous weigher by Electroweighers, Ltd.

HYDRAULIC SHOCK DAMPER

For the protection of structures and relative components from the damaging effects of violent shock or vibration, such as arise from earthquakes, on the gas ducting of atomic-power stations, Electro-Hydraulics, Ltd., Liverpool Road, Warrington, have introduced a new hydraulic damper. It is designed to provide utmost reliability as is demanded of these units but which in some cases cannot be approached during the life of the power station and in which the fluid must be changed from time to time.

As shown in the drawing, the closed



Part-sectional drawing showing detail features of the hydraulic damper developed by Electro-Hydraulics, Ltd.

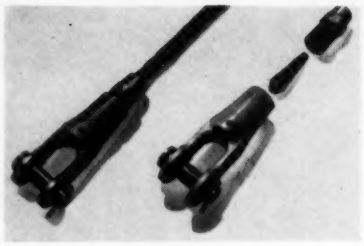
end of cylinder A, which is mounted vertical, has an integral forked-attachment lug and five fluid connections. Moving axially within it is a piston, with piston rod passing through a diaphragm G, dividing the cylinder into a reservoir and damper chamber. Sealing rings are fitted between the piston rod and diaphragm and the rod top cover gland.

When the piston moves down the cylinder, the fluid displaced passes through connection B, a one-way restrictor and into the reservoir. From the reservoir it will at the same time be drawn unrestricted through connection D into connection E of the damper. Movement of the piston in the opposite direction reverses this flow sequence.

The one-way restrictors limit the travel of the piston in the event of sudden movement. They do, however, offer a negligible resistance only during the slower movements. Longitudinal drillings in the piston rod permit the passage of fluid through non-return valves to both the upper and lower faces of the piston during recharging of the unit; fluid is discharged via the reservoir and out at a fluid level connection. An advantageous feature is that recharging does not interfere with operation, and if it operates while recharging is in progress, high pressure from the damper is prevented from reaching the filling lines by the non-return valves. If the damper is mounted in an inaccessible position, it can be recharged remotely.

WIRE ROPE TERMINAL

The great advantage of the new Tullcon wire rope terminal, which, after certain modifications, has now been approved by Lloyd's, is that it can be fitted on site by unskilled labour without any heating or degreasing, and it cannot be pulled off. The complete terminal, normally made in E.N. 8 metal, consists of a sleeve, a grooved and tapered pin and a terminal head. To fit the terminal, the end of the wire rope, from which a short length of core has been removed, is passed through the sleeve and the tapered pin is driven into the centre of the wire where it passes through the sleeve, each strand being laid in a groove in the pin. The ends of the strands are then inserted in the terminal head, which is screwed on to the sleeve. The screwing action re-lays the wire above the pin, making it impossible to withdraw the wire. An inspection hole in the terminal head enables the operator to check whether



Complete and exploded views of the Tullcon wire rope terminal

sufficient wire has been inserted to ensure absolute safety. Only shackle and stud-end terminal heads are in stock at present, but other types, such as bottle-screws and eye-ends, can be made to requirements.

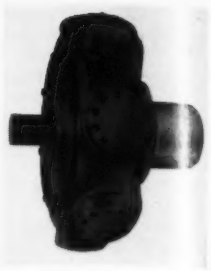
The Tullcon terminal is marketed by the Tulloch Construction Co., Ltd., 8 Laurence Pountney Hill, London, E.C.4.

PORTABLE CONVEYOR-ELEVATOR

The ALM range of conveyors has been extended by the makers, A. L. Marshall (Carlton), Ltd., Carlton, Nottingham, by the introduction of the ALM *Handiveyor* portable conveyor-elevator to meet the increasing demand for versatile inexpensive equipment of this kind. Although the incline variation is manual, the boom is evenly balanced, can be adjusted quickly and be very easily locked in the desired position by one operator. The boom is 13 ft 5 in long, has a maximum delivery height of 7 ft 3 in, will carry a distributed load of 2 cwt and will also operate as a horizontal conveyor at a height of 3 ft 3 in.

SLOW-SPEED HYDRAULIC MOTOR

Chamberlain Industries, Ltd., Staffa Works, Argall Avenue, London, E.10, manufacturers of the Staffa hydraulic equipment and tube-bending machines, have added to their range of slow-speed hydraulic motors the Staffa Mark V 7-cylinder model of 4-in bore dia and 3-in stroke, similar in general design to their



The Staffa Mk V 7-cylinder slow-speed hydraulic motor

5-cylinder type. The crankcase and cylinders form a monobloc casting, with the seven cylinders arranged radially and each fitted with a detachable head. At the normal working pressure of 2,000 lb/sq. in. the maximum output torque is 6,650 lb ft, with an overall efficiency of 94·2 per cent. The speed range is 0-75 r.p.m., and the driving shaft may be safely loaded to 6 tons overhang weight. For starting and peak loading the pressure can be increased to 3,000 lb/sq. in., giving an increased output torque of 10,000 lb/ft. The speed is infinitely variable within the stated range and in either direction of rotation.

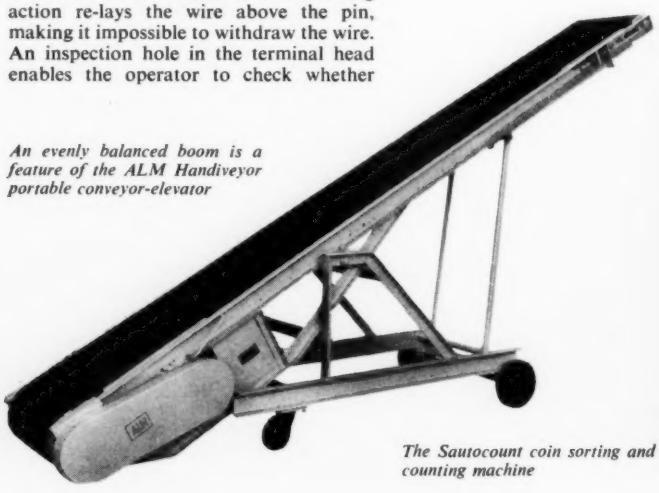
The new motor is already installed in several coal mining applications in this country, and in America is being used for dredgers, earth-drilling augers, conveyors, steel rolling mills, cranes and winches.

COIN COUNTING MACHINES

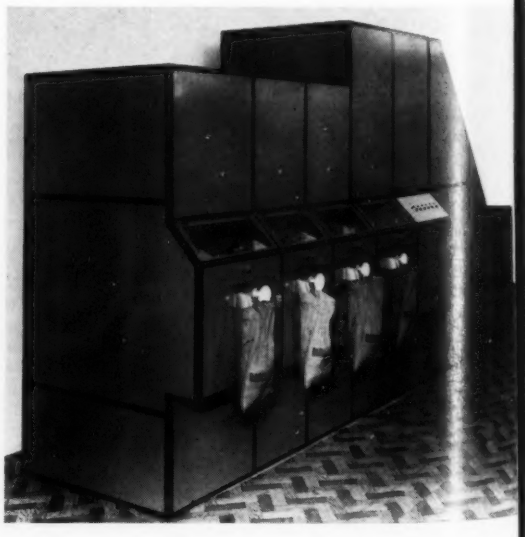
In the Sautocount machine introduced by International Coin Counting Machine Co., Ltd., Alexandra Road, Enfield, Middlesex, coins are shot into a hopper constructed to gravitationally feed them on to a conveyor belt of special design. The belt conveys the coins to a vibratory tray along which they travel until, according to their diameters, they are deposited into their respective storage hoppers. These are fitted with controlled feed mechanism, thereby delivering the coins as required, to adjacently situated counting machines.

The counting machines are equipped

(*Continued on page* 117)



An evenly balanced boom is a feature of the ALM Handiveyor portable conveyor-elevator



The Sautocount coin sorting and counting machine

with a further sorting device to safeguard against mis-sorting in the first separator and are also fitted with a variable stoppage mechanism, thus delivering coins in batches of from £5 to £100.

All parts of the machine are electrically interconnected to ensure that the machine will not be overfed with coins at any stage, for example, should one of the storage hoppers become full a safety device switches off the conveyor belt and sorters automatically switch on again, when storage capacity becomes available.

Westminster Bank, Ltd., who have installed one of these machines, claim that two operators can sort and bag £5,000 of mixed silver per hour without undue fatigue.

TRADE NOTES

New "Buildmaster" British Built

An agreement has been signed between Ruston-Bucyrus, Ltd., of Lincoln and Abelson & Co. (Engineers), Ltd., of Birmingham, by which Ruston Bucyrus, Ltd., are to manufacture Buildmaster Cranes under licence for Abelson & Co. (Engineers), Ltd., who will be the sole sellers of these machines in the United Kingdom and British Commonwealth.

This signing follows almost a complete year of preparation, work and trials, during which English drawings and specifications were produced and submitted for approval to one of the leading industrial insurance companies in the United Kingdom, to ensure compliance with B.S.S. 2799. Manufacture of the first two production models was completed in June and these machines were immediately put to work by two of the country's leading building and civil engineering contractors. Following observations taken upon these machines whilst working, plans were made for the necessary production lines to be laid down in the Ruston-Bucyrus works so that deliveries of the general-production machines could commence this spring.

These lines are now in full production and the first full batch of cranes is well advanced in manufacture.

New Quarrying Company

A new company founded in May of last year to quarry a magnesium limestone deposit at Coleford, Gloucestershire, for use in the roadmaking industry and as a mineral for agriculture, is now well established. The company—Stowfield Quarries, Limited, with a capital of £15,000—is run by Mr. R. D. Sims, who has been in the quarry industry for 31 years.

In the six months since it was founded, the company's employees have cleared trees—the site is in the Forest of Dean—and overburden; installed a Parker crushing, screening and storage plant which has an output of 300 tons/day and installed a weighbridge. The firm has supplied crushed material for many local roadmaking projects, including the Ross Spur motorway.

After primary crushing in a 25 × 14-in crusher, the material passes into a new plant made by Frederick Parker, Ltd. This consists of a 36 × 6-in '*Stonesizer*' granulator which has outputs of 33 × 36 tons/hr to minus 1½ in; a 22-ft *Oscillex* horizontal vibratory screen and a 40 × 96-in triple-deck 'Niagara' screen.

The screened products—⅛, ¼, ½, ¾, 1½, 2½ and rejects—are stored in nine storage bins which have total capacity of 195 tons. Electricity to drive the plant is generated on site.

Contract from Kuwait

J. G. Statter & Co., Ltd., a member of the Lancashire Dynamo Group, have been awarded a further contract by the Government of Kuwait Electricity Department to a value of £175,000 approx. for the supply of HV metalclad switchgear 11kV 350 MVA rupturing capacity to extend their distribution system. This follows on a previous contract placed with the same company for switchgear of like value some 18 months ago shortly after J. G. Statter & Co. introduced their new designs of 11kV metalclad switchgear.

Bowmaker Limited

A new office of the above company is now open at 11/13 Bridge Street, Stockport, Cheshire. Tel.: Stockport 6971 (Sub-Manager: T. E. M. Hawker).

New Heavy-Duty Fordson Clutch

Industrial buyers will be interested to know that a new 13-in heavy-duty clutch will, in future, be a standard fitting on all Fordson Power Major diesel skidded units for industrial use, and on the diesel version of the Fordson Power Major wheeled industrial tractor. The new clutch is also available as optional equipment to the standard 11-in clutch when required for

The first Ruston-Bucyrus 50R Buildmaster Crane erected for testing in the Ruston-Bucyrus works at Lincoln

Stowfield Quarries Limited's new plant at Coleford, Gloucestershire

diesel tractors in agricultural use.

The new clutch has many satisfactory features. The considerable contact area, for example, provides for the rapid dissipation of the extra heat that is experienced under intense industrial usage. There is a greased release bearing by means of a grease cup mounted on the front transmission housing, and a four-finger toggle action. Torque reaction is taken on four straps, and, although these are fixed to the cover, their flexibility makes them readily able to accept the type of shock loadings which are encountered in heavy industrial work.

Lord Craigton's Tribute to Scottish Enterprise

On December 15th last, Lord Craigton, Minister of State for Scotland, and Sir Ian A. Johnson-Gilbert, Lord Provost of Edinburgh, visited the Castle Mills, Edinburgh, factory of The North British Rubber Co., Ltd., to view the new hose plant which is the main feature of the company's £3 million modernization programme just completed.

Following the visit Lord Craigton said, 'I am sure you have all been just as impressed and stimulated as I have been by what we have seen this morning. The North British Rubber Company are to be congratulated on these new works, which, I am told, have cost about £3 million. The company are particularly to be congratulated on choosing to make this development here in Scotland. I understand that when they were thinking of modernizing their factory they considered going to the Midlands of England. However, they decided to stay in Scotland. That was an eventful decision, and an example of that enlightened self-help that we must encourage in Scotland.

'This is something of a trans-Atlantic occasion to-day. The company was started in 1856 here at Castle Mills with a manager and four skilled workers, all of whom had come from the United States. Think of the change to-day—over three thousand employees in Scotland'.

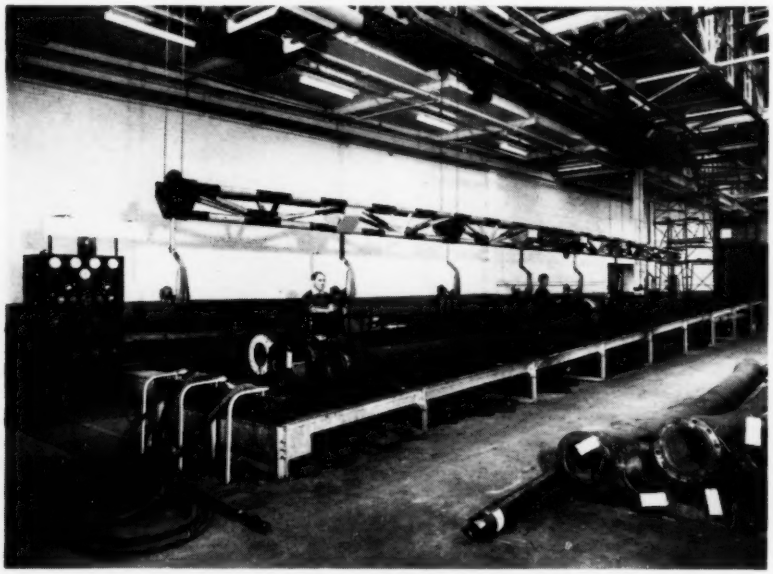
President of India performs Opening Ceremony at Durgapur

Recently the President of India, Dr. Prasad, commissioned the first blast furnace at the Durgapur Steelworks, West Bengal. The Durgapur Steelworks represents the largest single export order ever obtained by Great Britain. This great contract, to the value of £105 million, is being carried out for Hindustan Steel, Ltd., by the Indian Steelworks Construction Company, Ltd., ISCON, the consortium formed specially for the purpose.

The ceremony mentioned celebrated the inauguration of an integrated steelworks and not just the completion of one blast furnace. The coke ovens are complete with a coal washery and by-products plant. The blast furnace is complete with a gas-cleaning plant and pig-casting machine. The power plant is complete with all its standby units. In addition, the central engineering maintenance department, foundry and stores department are very largely complete.

Durgapur is a joint Indian-British effort and approximately 50 per cent of the capital expenditure and tonnage of raw materials has been supplied by India herself. Of the 33,000 labour force on site the vast majority are Indian; this includes a high proportion of skilled Indian supervision. The number of British technicians working at Durgapur is, in fact, under 400.

Giant oil suction and discharge hose is an ever-increasing export of The North British Rubber Co. of Edinburgh through their associates U.S. Rubber International (Great Britain), Ltd. Illustration shows the oil hose test area with hose being mounted on test tank ready for pressure and vacuum testing. Oil hose is tested to 250 lb/sq. in. and some lengths weigh as much as one ton. Rotary drill hose, also a big export item, is tested up to 5,000 lb/sq. in.



In order to provide for the operation of the steelworks, 350 Indian technicians are being trained, through the Colombo Plan, in the United Kingdom. Others are being trained in Australia, the U.S.A. and other countries. In addition, the British Iron & Steel Federation have seconded technicians from this country to Hindustan Steel, Ltd., to assist in the initial operation of the steelworks and to complete the training of the Indian technicians.

The members of ISCON are thirteen of the most famous firms in British industry. They are:—Davy and United Engineering Company, Ltd.; Head, Wrightson & Company, Ltd.; Simon Carves, Ltd.; The Wellman Smith Owen Engineering Corporation, Ltd.; The Cementation Company, Ltd.; The British Thomson-Houston Company, Ltd.; The English Electric Company, Ltd.; The General Electric Company, Ltd.; The Metropolitan-Vickers Electrical Company, Ltd.; Sir William Arrol & Company, Ltd.; The Cleveland Bridge & Engineering Company, Ltd.; Dorman, Long (Bridge & Engineering), Ltd.; Joseph Parks & Son, Ltd.

New Canteen at Exide Works

Recently A. W. Browne, O.B.E., M.I.E.E., chairman of Chloride Batteries, Ltd., officially opened the new canteen at Exide Works, Clifton Junction, Swinton, Manchester. To mark the occasion a Christmas dinner was served free to all the workers and office staff.

A new single-storey building, designed in contemporary style by the company's own Architect's Department, occupies nearly 40,000 square feet and is probably one of the largest canteen buildings on one floor in the north of England. It replaces three separate buildings previously used and is removed from the factory proper as required by the Factory Regulations for lead-using industries.

The building, which has been erected at a cost of over £150,000, comprises works dining room, staff dining room, senior staff dining room and visitors' room in which trade visitors will be entertained before proceeding on a tour of the works.

Scotland's Largest Wine Store

Construction has begun in Glasgow on what will be the most revolutionary structure in Scotland specifically designed and built for the storage and handling of wine.

Embodying the very latest techniques in design and construction, the new single-storey warehouse will reproduce cellar conditions exactly. Designed for John Harvey & Sons, Ltd., Bristol, by Peter Falconer of Ellery Anderson, Roiser and Falconer, Stroud, the warehouse plan has been conceived in the light of mechanical handling requirements and the consequent need for the careful allocation of space.

It will be possible to store cases of wine up to 18 ft above floor level by means of Skid-Stac methods of handling. All incoming and outgoing cases will be moved

(*Continued on page* 119)

on hardboatd pallets—e.g. eases can be moved straight from delivery vehicles on to electrically powered Conveyancer trucks which will take them to the appropriate bins in the warehouse. Loading bays have been eliminated.

The problem of reproducing cellar conditions exactly has been solved by maintaining an even temperature through exclusion of the sun, temperature control, air-conditioning and the provision of double cavities in the external and lining walls. The roof will be covered with double or treble layers of insulation.

Martonair Record Airfreight

Recently Trans-Canada Air Lines carried one of the largest single consignments yet freighted by them from London Airport. The consignment consisted of pneumatic cylinders despatched by Martonair, Ltd., to their Canadian company, Martonair (Canada), Limited, of 25, Carson Street, Toronto, Canada, and weighed 1633 lb (741 kg). Because of the exceptional weight, the consignment was split by T.C.A. into two—798 lb on Friday, 835 lb on Saturday. Martonair shipments earlier in the week brought the total for six days to 2637 lb (1,200 kg).

This consignment to Canada was in addition to the normal weekly and daily 'milk-run' by air of castings, components and sub-assemblies to Europe and the rest of the world.

Handling with Industrial Trucks

In the November 1959 issue we published Part 2 of the above article by L. J. Hoefkens. The caption for Fig. 40 stated that the Yale truck illustrated was of 30 cwt capacity. This should have been 3,000 lb.

Marion Power Excavators and Cranes

Marion Power Shovel Company excavators and cranes in several models will be manufactured in Scotland at the Dalmuir works of Babcock & Wilcox, Ltd., under an agreement announced recently by James Mullaney, President of Universal Marion Corporation, of which Marion Power Shovel Company is a division. These machines will be marketed and serviced by Blackwood Hodge & Co., Ltd., 25 Berkeley Square, London, W.1.

Mr. Mullaney stated that the facilities and skills of the Babcock & Wilcox Dalmuir organization were admirably suited to the manufacture of high-quality power shovels and cranes. An established leader in the field of heavy mechanical engineering, the company's Renfrew factory is among the world's largest manufacturing plants devoted to the production of land and marine boiler plant and auxiliary equipment. Babcock & Wilcox have built giant steam plants and are active in the design and construction of atomic power stations and the development of nuclear ship propulsion. The forging and casting facilities at the Renfrew plant will be ideal for supplying components for excavating and crane equipment.

The Dalmuir plant, where machinery, fabrication and assembly will be handled, has a total of 35 acres in the main factory area, 21 of which are under roof. Readily accessible by water, rail and road, it is well equipped with the large machine tools, overhead cranes, welding and heat treating facilities, and assembly areas necessary to the efficient handling of the large units involved in excavator manufacture.

Prior to its acquisition by Babcock & Wilcox in 1959, the Dalmuir factory produced armoured fighting vehicles and tanks for the Royal Ordnance Department. The facilities have since been expanded and it has been producing industrial cranes, nuclear power plant and other heavy equipment. Among its most unusual products is a Goliath crane over 240 ft high with a 400 ton capacity.

Customers in many parts of the world, as well as the companies involved, are expected to benefit considerably from this new combination of European manufacture and sale with Marion's 75 years of experience in product design.

Marion Power Shovel Co. manufactures a complete line of diesel- and electric-powered shovels, cranes and draglines, ranging in size from $\frac{3}{4}$ yd to the world's largest 65- and 70-yd stripping shovels.

Trucks for Steel Company of Wales

After exhaustive tests, The Steel Company of Wales have selected Yale Series 51 fork lift trucks for use in the reorganization of their main engineering spares stores at Ffrwdwyllt and Abbey. The first two trucks, battery-electric models of 8,000 lb capacity, have now been delivered.

When completed, the stores will hold 60,000 different stock items valued at about £4 million. More trucks will be required as the stores become fully palletized.

The trucks, fitted with a side-shift attachment, are equipped with side, tail and spot lights, very high-capacity batteries, canopy guards and discharge indicators.

MARCH

The above issue will contain the following articles

Fluidized Handling of Alumina Powder

Handling with Industrial Trucks—Part 6

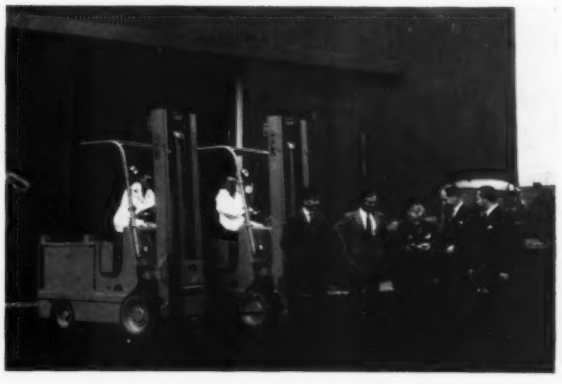
The Application of Vibratory Power to Mechanical Handling

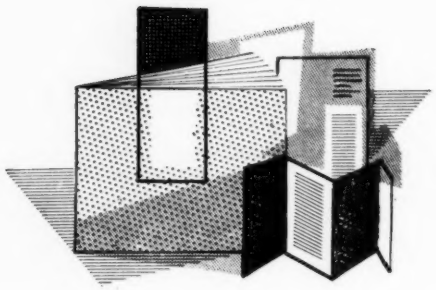
Integrated Materials Handling at the Ford Motor Co., Ltd.

and Regular Features

A typical Marion power excavator

Handing over the first two Yale trucks to representatives of The Steel Company of Wales. Left to right M. J. Stuart, Sales Manager (Export) of The Yale & Towne Manufacturing Co., N.W.G. Dolling, Manager—Mobile Plant & Stores, The Steel Co. of Wales; A. Henderson, Chief Mechanical Maintenance Engineer, The Steel Co. of Wales; V. G. A. Upton, South Wales Area Sales Manager and H. Davis, Sales Manager (U.K.), both of Yale & Towne





ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

LOADING ORE

New Ore Handling Plant in the Rotterdam Port. By H. van Rossen. *Fordern und Heben.* Bahnhofstrasse 61, Wiesbaden, Germany. November, 1959. Pp. 695-700.

To meet the increased demand for ore in the iron and steel works on the Lower Rhine, a large ore-handling plant has been put into service by the NV Stuwadoors Maatschappij Kruwal in the port of Rotterdam. The author describes the plant in detail. Briefly, it comprises four mobile loading bridges having a span of about 230 ft and fitted with a jib, which is raised by an electric motor to give a lifting height of about 47 ft. Suspended under the jib is a travelling and slewing trolley of 16 tons capacity, having a cabin at the outer end for an operator who controls all its movements for loading the ore into Rhine barges. It is stated that up to 5,000,000 tons of ore are handled annually.

FORK TRUCK WITH VACUUM LIFT

Vacuum Lifting Devices Hold Non-Porous Materials. Steel, Penton Buildings, Cleveland 13, Ohio, U.S.A., 30 November, 1959. P. 123. 50c.

The handling of barrels, plates or sheets by fork lift truck is said to be faster, safer and more economical by the use of a vacuum-powered lift attachment. This is a self-contained unit having four 10-in vacuum pads mounted on a frame that can be slipped on to the truck forks. The lifting capacity of each pad is 500 lb. The pads are available in 8-in, 12-in or 16-in sizes. Vacuum is created by an engine-driven pump, and a reserve vacuum system ensures safety should the engine fail.

UNLOADING PALLETLESS LOADS

Holding Bar Keeps Palletless Load in Place as Truck Backs Away. *Design News.* 3375 S, Bannock, Englewood, Colorado, U.S.A. November, 1959. Pp. 34 and 35. $1.

An electric fork lift truck attachment described serves to hold a palletless load stationary as the truck is backed away to unload it. It consists of a swinging holding bar actuated by two double-acting hydraulic cylinders. When the truck has been moved so that its load is in the required position to be deposited, the operator moves the control handle forward. This automatically brings the first reverse speed into operation and at the same time causes the holding bar to be hydraulically swung forward, applying a force of about 400 lb to hold the load stationary as the forks are withdrawn from under it. A mechanical linkage extends the bar as it swings away from the front of the truck to keep the point of contact on the load at approximately the same height throughout the 36 in of horizontal travel. A hydraulic side shifter also permits the load position to be adjusted 6 in to either side, as may be required under tight loading conditions. A button on the control handle permits the second reverse speed to be used if necessary when unloading on a gradient.

FOR CLEANING CONVEYOR BELTS

Carry-Back Problem Solved by Conveyor Belt Brush. *Rock Products.* 79 W. Monroe Street, Chicago, Illinois, U.S.A. October, 1959. P. 182. $1.

A new synthetic bristle material, called Korfil P, used for a conveyor belt cleaning brush does not, it is stated, absorb moisture, soften or become brittle in extremely low temperatures, is extremely strong and performs excellently on wet and abrasive materials. Its inherent qualities provide fast and thorough cleaning action, and the material has a longer wearing life than any other synthetic on the market. The brush consists of an extruded aluminium mounting with individual strip brush inserts, and it will sweep a belt clean without injuring its surface.

AUTOMATIC ASH EXTRACTION

Riley Chain Gate Ash Extraction. *The Steam Engineer.* 90 High Holborn, London, W.C.1. November, 1959. P. 71. 2s. 6d.

Suitable for installation with new or existing Riley Type T. chain boiler grate stokers, the conveyor-type ash extractor described is said to be so designed that there is very limited wear of the moving parts since the ash is stationary on the apron plates and moves with the conveyor. A $\frac{1}{3}$-h.p. geared motor drives it at constant speed, and ashing is carried out automatically during operation of the boiler plant, without the need to shut off the forced draught fans, while preventing ingress of cold air during cleaning. A steam cleaning assembly removes any fine particles of ash which may penetrate to the inside of the extractor. The ash box at the front provides for an ash chute to a water trough conveyor, or can be fitted with a drawplate for discharging ash into a low trolley or pan with runner attached.

PROTECTING CRANE OPERATORS

Crane Boom Safety Device. *Maintenance.* One River Road, Cos Cab, Connecticut, U.S.A. November, 1959. P. 48. $3 annual subscription.

To prevent crane booms from making contact with overhead electric power lines, and possible death or injury to the operators, the new protective shield described has, it is stated, been tested with more than 50,000 volts. It is made of steel tubing and incorporates four heavy-duty insulators which prevent the flow of electricity. It is also made weatherproof with heavy plastics marine coatings.

SPEEDED-UP FROZEN MEAT HANDLING

Containerized Refrigerated Meat Delivery. *Industrial Refrigeration,* 433 N Waller Avenue, Chicago 41, Illinois, U.S.A. October, 1959. Pp. 24 and 25. 25c.

This article refers to a new delivery system in operation in Minnesota, designed to bring to customers the freshest meat directly from the packing house to the retailer in sealed, refrigerated truck body containers. It eliminates a previously necessary operation of unloading a large road vehicle and reassembling and loading the meat again into a number of smaller refrigerated delivery trucks. It also keeps the meat completely sealed and at constant temperature throughout the process.

The system employs twelve aluminium containers, two 40-ft aluminium flat platforms, two-axle semi-trailers, one fork lift truck, two diesel-engined tractors and six delivery chassis. Three containers are accommodated on each semi-trailer, and each is loaded by conveyor with 5 tons of meat. Special locking mechanism anchors the containers to the vehicles for travelling, and this is automatically un-

(*Continued on page* 121)

locked by the fork lift truck when the forks are inserted to transfer the containers on to the retailers' delivery vehicles.

QUICKER CARGO HANDLING
Standardized System for Handling Containers. *Marine Engineering*. 50 Church Street, New York, N.Y. U.S.A. November, 1959. Pp. 138 and 140. 75c.

A container-handling system described is said to be the first to afford standardization to shippers and carriers. It is completely automatic in operation and provides increased capabilities for cargo handling with lower costs. Operation can be performed electrically, hydraulically or pneumatically, and the system is adaptable to any commercial container, crane or vehicle.

The main components are top-corner and bottom-corner castings attached to the container structure, a crane lifting spreader, equipped with coupler latches and wired for an electrical safety interlock system, aligning wings and lifting cable sheaves. The coupler latches automatically engage into the container top-corner castings without manual assistance. Also supplied are adaptor castings for stacking cargo containers on a ship's deck or in terminal storage, and hatch cover castings to lock containers to the deck. In addition, there are anchor castings for rail and road vehicles.

Limit switches at the four corners of the spreader render the electrical circuits inoperative and prevent the container from being hoisted unless all coupler latches are engaged and their latch locks properly positioned. Where more than one length of container is handled, a supplementary spreader for the container size needed can be attached to the crane spreader, permitting intermittent handling of various size containers.

RECENT PATENTS

The following are brief extracts of recent United Kingdom patents which we believe will interest our readers. For full details the original patent specifications should be consulted at, or bought (3s. 6d. each) from, The Patents Office, Southampton Buildings, Chancery Lane, London, W.C.2.

FLUENT CONTAINER
Stockholm Superfosfat Fabriks A.B., of Sweden—U.K. 817160.

Pulverulents handled in cube containers with a cut off corner as closure and pourer.

TRENCH DIGGER
L. Allsop, of Lakenheath—U.K. 817186.

Excavator and ditch cleaner, mounted on a boom, pivoted to give semi-automatic use.

TOW HOOK
Clyde Shipping Co., Ltd.—U.K. 817187.

Given form with bracket and pivot for deck installation.

BAR HANDLING
Salem Brosius Inc., of Pittsburg.—U.K. 817198.

For long bars and tubes, etc., with ejection device on to further beds or guideways, under gravity feed.

DIP COATING
Glaswerke Ruhr A.G., of Essen—U.K. 817226.

Glass containers are coated with liquid resin and plastic, by dipping from a conveyor whose carriers rotate through 180 afterwards, yielding a uniform coating.

TRANSFER MECHANISM
Westinghouse Electric International Co.—U.K. 817266.

A tubular carrier and conduit for reactor fuel loading and handling.

BARREL CLAMP
R. L. Renfroe of Jacksonville—U.K. 817310.

For use in handling of variable diameter barrels, using a sling chain and brackets.

CLAY CAKE DRYING
W. Hancock, of Stoke—U.K. 817337.

Wheeled truck with upright porous frames for taking clay tiles into ovens for drying.

WORKS CONVEYOR
G. M. Pfaff A.G., of Pfalz—U.K. 817427.

Factory transporter mechanism working on both upper and lower runs, with drag chains having grips and pushers.

GRAIN CONVEYOR
Andrew Young & Son, of Glasgow—U.K. 817344.

Particle. etc., conveyor using a cylindrical conduit and a spiral screw, supported by a cantilever.

CONVEYOR CONTROL
John Hounsell Engineers Ltd., of Birmingham—U.K. 817448.

Periodic of a conveyor is controlled in register with cutters, etc., using springs and electro magnets co-operating with strikers and stops.

HOIST
Jennings Winch & Foundry Co., Ltd., of Sunderland—U.K. 817476.

The cable or rope feed on ship is stabilized to prevent whip or sag and give correct coiling under heavy derrick loads, using three pulley sheaves.

TRACTOR BOOM
Mid Western Industries Inc., of Wichita—U.K. 817647.

Load raising and tool carrying boom for bulldozing which obviates tendency to lift.

FISH LAYERING
E. Kroll, of Hamburg—U.K. 817652.

Fish packed into barrels using screw feed chutes with automatic addition of liquid pickle, etc.

TORQUE CONTROL
Yale & Towne Manufacturing Co., of New Tork—U.K. 817655.

Industrial truck with hydraulic torque converter, allowing slipping clutch to give inching progress forward, whilst braked and hoisting.

WASTE SHAKER
Pneumatic Conveyors Huddersfield, Ltd.—U.K. 817682.

A textile waste cleaning machine with worm conveyor and beater.

LIFTING DOGS
W. & E. Moore, Ltd., of Poplar—U.K. 817796.

A pair of lifting dogs are pivoted like tongs, and avoid automatic closure on lifting by using alternate pick and release teeth on a can which works with a pivoted pawl.

POWERED LIFTER
R. H. Hooton, of Blyton, Lincoln—U.K. 817799.

A power lift attachment for handling sacks and bags, using a pivoted frame and grippers.

LOADER
Ibbett Engineering Co., Ltd., of Bedford—U.K. 817819.

Improvement on patent 698811 for a trailer with retractable wheels at rear and a pivoted unloading, etc., ramp.

CONVEYOR
Richard Sutcliffe, Ltd., of Wakefield—U.K. 817991.

Form of hydraulic valve and lever for conveyor tensioning.

WINCH
Metropolitan-Vickers—U.K. 817999.

Reactor winch cable pulley with flat spiral and biased roller to indicate movement.

ROAD SURFACING
Johnston Brothers Contractors, Ltd.—U.K. 818004.

Machine to give adequate flow of asphalt, etc., fed by tipping lorries using a pivoted delivery chute.

FURNACE CONVEYOR
Ofu G.m.b.H., of Dusseldorf—U.K. 818013.

Device for rapidly inverting trays at exit from furnace and putting on to return track, can take pallets.

REVERSIBLE STACKER
U.K.A.E.A., London—U.K. 818015.

For use with flat bodies, e.g. in measureing radiation of samples presented under remote control, using hollow cylindrical cams.

CONVEYOR
Bottoms Connelly & Co., Ltd., of Ealing—U.K. 818043.

Chains with flanged wheels run in channels made from double thickness wear-resistant steel strip which is reversible.

CONVEYOR TRANSFER
T. & T. Vicars, Ltd., of Lancaster—U.K. 818060.

Transfer slide or tip at angle between two conveyors, e.g. in bakeries, which runs faster than input.

BALANCE CHAINS
Iso Speedic Co., Ltd., of Coventry—U.K. 818085.

Relate a hoist chain for fork trucks counter-balance weights, having guides without flanges at the pulley edges, so they are cheaper, simpler or smaller.

VESSEL HANDLING
Philips Electrical Industries, Ltd.—U.K. 818087.

A horizontal turn-table for decanting liquids from glass vessels, e.g. in delivering by tilt.

SKIP ASSEMBLY
F. V. Cutting et alia—U.K. 818225.

A rockable skip for rear mounting, with control of rate of tip using a double-acting ram.

PNEUMATIC ELEVATOR
Henry Simon, Ltd., of Stockport—U.K. 818238.

Improvement on patent 684169 using fluidized lift and control with impurity removal, e.g. for grain, with the separation in a slatted expansion chamber.

LOAD HOIST
R. A. Neaverson, of Leicester—U.K. 818411.

Loader for warehouses, lorries, etc., having a pair of pivoted arms carrying load supporting cross bar with hooks, etc., on it, the whole being raised by chains.

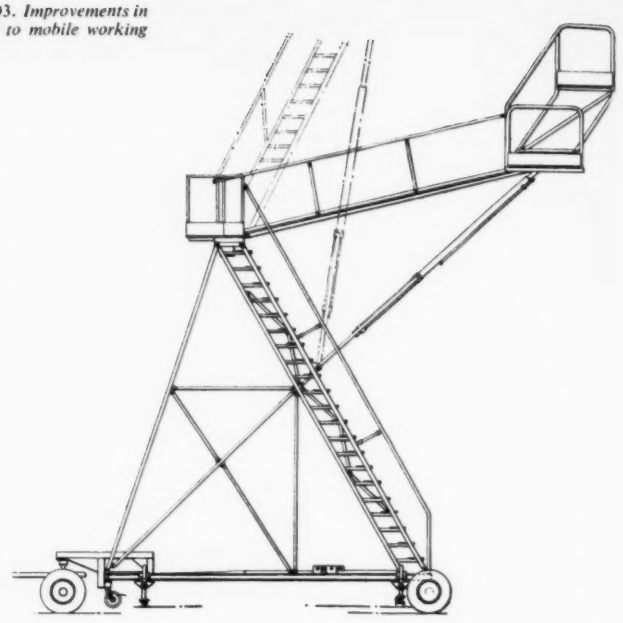
TROLLEY CONVEYORS
Fisher & Ludlow of Birmingham—U.K. 818451/2/3.

Wheeled trolleys run on the floor driven by overhead cables or chains, and have special aids to help on gradients of 20 or so, by having an additional support over the incline, using driving or retarding cogs near the base. Patent 639244 is mentioned, and additional conveyor belts over short inclined lengths are also suggested, as well as a spring mechanism to give rapid disconnection from the overhead drive.

MASTED TRUCKS
Clark Equipment Co., of Michigan—U.K. 818457/8.

Patented form of load lift carriage rollers with resistance to lateral forces on the stationary uprights.

No. 818,493. Improvements in or relating to mobile working platforms



MOBILE PLATFORM
Access Equipment, Ltd., of Hemel Hempstead.

Access Equipment, Ltd., of Hemel Hempstead, in B.P.818493 relate a form of mobile working platform on a chassis, which can be assembled on site without need of a crane, with the boom supported by a hydraulic jack.

MOVABLE CARRIER
A. A. Tennant, of Washington—in U.K. 818800.

Truck, etc., load carrier easily removed from trailer, etc., by rollers, on to ship or rail flat car.

CIGARETTE MAKING
K. Korber, of Hamburg—U.K. 818806.

Conveyor feed includes a compacting steel belt of reduced wear, capable of variable speed control.

HATCH COVERS
Mennens & Co., Handel Maatschappij, of Rotterdam—U.K. 818968.

Coaster ship hatch covers with securing strip over whole surface, having rope supports of minimum sea surface, also able to help hold deck cargo against waves.

BREAD ROLLING
M. Clausse of Belgium—U.K. 819007.

A dough rounder device with reciprocating motion between a disc and roof, using a conveyor belt support.

SLAB HOLDER
Aktiebolaget W. S. T. Patenter, of Sweden—U.K. 819254.

A piled slab mover with single release using a resilient tube and U-shaped holding framework.

3 AXLE ROLLER
Koehring Co., of Milwaukee—U.K. 819266.

Using floating guide roll and beam with two steering rolls on the road.

ROAD ROLLER
Dinglewerke A.G., of Germany, in U.K. 819300.

A form of vibratory roller with the minor pair on gimbals, for steering, spaced on either side at the rear, outside the main one. The working cylinder does not act directly against the chassis.

STRAW CONVEYOR
O. L. Justesen, of Denmark—U.K. 819516.

Forage handler with inclined open box shape, using tine or spike carrying chains, of easily adjusted height, able to release the tines partly or wholly as desired.

CARCASS HANDLING
A. B. Thomas Ths., Sobrae & Co., of Aarhus—U.K. 819578.

A refrigerator conveyor plant so arranged that the cooling of carcasses, etc., is more by radiation and less by convection, than usual, avoiding spoilage of product.

DERRICKS
Eikomag Eisenkonstrucktionen A.G., of Dusseldorf.

Eikomag Eisenkonstrucktionen A.G., of Dusseldorf, in B.P. 819687 outline a well-drilling derrick comprising posts at edges of a pyramid, and having a crown platform and gallows on top, so made as to be easily reassembled with the upper leg parts acting as the lower at the new site.

BOTTLE FEED
B. G. Tolley, of Victoria, Australia—U.K. 819745.

Conveyorized jar or can feed to handling machines, e.g. washers, sterilizers, which is automatic, uses chain or belt drive from the main conveyor, via stalls, with rotation to avoid jamming.

SHOVEL
P. J. M. T. Allard, of France—U.K. 819797

Loader machine with inclined passage and hydraulic tipping which needs no anchor to the ground since it has large areas of runway under the chassis. Patent 773840 is mentioned.

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